A mental model for successful inter-disciplinary collaboration in curriculum innovation for information literacy

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The University of Pretoria introduced a compulsory Information Literacy module to address the need for delivering motivated knowledgeable employees that embrace information and have the skills to find, select and use relevant information accurately, efficiently and effectively in an explosive information age. Low class attendance, an indication of unmotivated students, as well as the limited scholarly application of information literacy skills in consecutive academic years of study have been identified as possible barriers to the application of the desired skills. A collaborative action research project based on Whole Brain principles was introduced to motivate learners through innovative learning material in the module. A deeper understanding of the role of thinking preferences and thinking avoidances is essential in selecting a team that is responsible for the planning, design, development and delivery of learning opportunities and material. This article discusses the Whole Brain Model® as a mental model that underpins the successful collaboration of multidisciplinary teams and enhances innovative curriculum design that addresses alternative approaches to the teaching of Information Literacy.

Keywords: Whole brain learning; information literacy curriculum; thinking preferences, collaboration

1 Background

The explosive information age of the 21st century demands that higher education institutions deliver motivated, knowledgeable employees who embrace information literacy and have the skills to find, select and use information accurately, efficiently and effectively. In response to this need the University of Pretoria has introduced a compulsory semester module to prepare its students. The Department of Information Science is responsible for delivering the module in Information Literacy (IL) annually to a growing number of first year students from all faculties. This extremely large and diverse group of students is divided into smaller groups of fifty students who are taught in computer laboratories by 16 assistant lecturers. The same lecture and/or practical is repeated throughout the week to accommodate all students.

The IL module is based on the process model for information literacy (Berkowitz & Eisenberg 1987) and the REACTS model (Thomas 2004). The learning material is based on a textbook: *Navigating information literacy: your information society survival toolkit* (Bothma, Cosijn, Fourie & Penzhorn 2008). PowerPoint slideshows, which summarise the chapters within the book, are made available to the assistant lecturers in an endeavour to assist them in their presentations. Extra examples of how to do database searches are available to students in the Learning Management System (LMS). The learning outcomes of the module are assessed by means of objective test items in an electronic assessment system.

Low class attendance has indicated that students are not motivated to attend the module. Furthermore, the scholarly application of IL skills in other modules is limited and often not evident in successive years of study, despite the acceptable pass rate. An analysis by Shenton and Fitzgibbons (2010) reveals that a lack of self-motivation of students and isolated rote learning are two of the largest barriers to the application of information skills.

1.1 Phase 1: the baseline study

In a baseline study (Phase 1), results were presented at the IFLA pre-conference meeting in 2009 titled "Facilitating whole brain learning: an innovative option for information literacy". It was highlighted that students across faculties have different thinking preferences and therefore a teaching methodology embracing a *one fits all approach* is not effective. The Herrmann Brain Dominance Instrument™ was used in this study to measure and understand individual thinking preferences and areas of thinking avoidance as well as the impact on teaching and learning.

The theoretical framework for the study reflects the multidimensional nature of the higher education practice in question and the professional learning context of the participating university staff members. The core of the theoretical framework, as it is aligned with applicable learning theories, such as constructivist professional learning, self-regulated

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professional learning, action learning for professional development and co-operative professional learning, is whole brain learning (Herrmann 1996). Figure 1 provides an overview of Herrmann's Whole Brain Model® (Herrmann 1996:15).
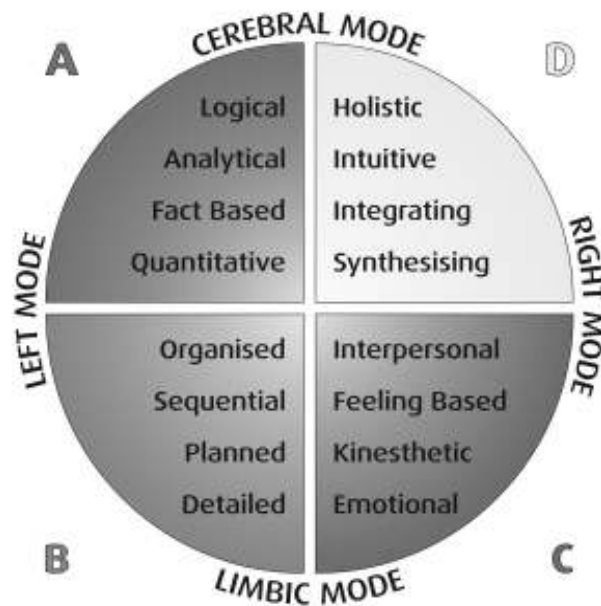

Figure 1 Herrmann's Whole Brain Model ® (Herrmann 1996:15)

The mental model is based on four separate,distinct but interdependent and interrelated quadrants.

1.2 Phase 2
Phase 2 of the project determined the thinking preferences of the assistant lecturers to sensitise them to the challenges posed to the teaching and learning of students with diverse thinking preferences. A staff development professional offered regular training interventions enabling assistant lecturers to develop Whole Brain© activities in accordance with our proposed model.

The impact of the assistant lecturers' application of Whole Brain principles was evaluated at the end of the second semester of 2009. Semi-structured focus group interviews were conducted with the assistant lecturers as well as with the students. The information obtained from these interviews was used to construct questionnaire items. The questionnaire was administered during the last week of the semester to gain insight into the nature of the issues raised by lecturers as well as students.

The results of the 2nd phase indicated the following:
- Only 50% of the students thought that the lecturers made provision for variety and change in the classroom.
- The students' expectations regarding the use of learning media such as PowerPoint slides, the Internet, whiteboard and the LMS had been met, but they expected more use of the textbook, video, games and multimedia during classes.
- Students indicated that they would make use of a CD with exercises provided with the textbook (78,9%), additional activities in the LMS (87%), more exercises to do on their own in class (71,7%) and at home (55%).
- By evaluating the existing learning material and activities with the Whole Brain Model® it became evident that the activities addressed primarily A- and B-quadrant thinkers, without taking into consideration students whose thinking styles fall into the C- and D-quadrants.

This confirms that not all assistant lecturers provided the same creative input to address the diversity of thinking styles. The outcome of this phase provided impetus for Phase 3, which is the focus of this article.

1.3 Phase 3
The Department of Information Science adopted the idea of developing a "teaching toolkit" to ensure optimisation of preparation for learning opportunities, incorporating innovative ideas that address Whole Brain Thinking, and utilising the University's resources to enhance teaching and learning in the module. This toolkit consists of instructions and a number of learning activities that make provision for Whole Brain Teaching and Learning™. Phase 3 focuses on the design, development and implementation of a "teaching toolkit".

1.3.1 An interdisciplinary research project

The Department initiated a collaborative project titled "Facilitating whole brain information literacy: an interdisciplinary research project". The objectives of the project are to determine:

- how the Whole Brain Model® can be used to improve effective learning
- how the Creative Whole Brain Process® can be applied to innovate the IL programme
- what material needs to be developed to facilitate Whole Brain learning™.

It was decided to engage all members involved in teaching IL in the project to ensure academic integrity and at the same time innovate and transform the teaching and learning environment.

Action research forms the basic research design. A mixed-methods approach is followed in order to address all the research questions. The data sets reported consist of quantitative data, as obtained by means of the Herrmann Brain Dominance Instrument™ (HBDI™).

From the literature consulted it is evident that the success of a research project can be enhanced if the principles of Whole Brain Thinking© are applied. A team's success depends on the ability to leverage the characteristics of all of the team members to create a balanced team (Wysocki 2002:8). Therefore the Whole Brain Model® and Herrmann Brain Dominance Instrument™ (HBDI™) (Herrmann 1996:29) was adopted as a research tool and way of doing for this project, based on the extensive research done by Wysocki who concludes that "no other assessment tool in the market has the breadth of application to project management as the HBDI" (Wysocki 2002:88).

Individuals are unique and have different thinking preferences (Herrmann 1996:17). Therefore in any project management process one should acknowledge that throughout the different phases of a project this diversity is evident. Understanding this mental diversity not only improves team effectiveness but ultimately promotes the quality of products. It is also important to know that every project, like individuals, is a mixture of all four quadrants, with some quadrants having a stronger representation than others (Wysocki 2002:171). Every project reflects some tendency towards each characteristic, and in extreme cases a single characteristic may dominate the project. The four characteristics are the following:

Analyse: Projects that score high on analysis dimensions are characterised by a high incidence of logical processing, formulae and data analysis probably associated with problem solving, diagnosing, explaining how things work and clarifying issues. These projects involve the design and development of new or revised processes and procedures. Engineering, information technology and construction projects score high on this quadrant (Herrmann 1996:24; Wysocki 2002:172).

Organise: Projects that score high on the organising dimension are characterised by having an ordered, planned and controlled environment and that follow an established process and procedure to complete the work of the project. Implementation and business processes, re-engineering projects and projects that are repetitive or follow a well-defined set of templates score high on this quadrant (Herrmann 1996:24; Wysocki 2002:172).

Personalise: Projects that score high on the personalised dimension are characterised by a high degree of people interaction throughout the life of the project. Groups are consulted during each phase of the project. It is important to the success of the project that all affected parties buy into the project. Such projects are further characterised by the need for a strong communication plan and its management. Projects of which the scope and goal are not clearly defined or understood by all parties require considerable interaction between the project manager and the customer and will therefore score high in the C-quadrant. These types of project must be characterised by a shared vision and highly collaborative relationships with their clients (Herrmann 1996:24; Wysocki 2002:172).

Strategise: Projects that score high on strategising dimensions are characterised by stepping outside the box and taking risks, creating innovative solutions, being change-orientated, and experimenting with and selling new ideas and new ways of doing things. Such projects are groundbreaking projects because they may involve using breakthrough technologies in challenging ways. Business process re-engineering projects score high in the D-quadrant, as Web design projects, as well as designing and developing new and innovative ways of teaching (Herrmann 1996:24; Wysocki 2002:72).

1.3.2 Research methodology of Phase 3

A multidisciplinary team implemented Whole Brain principles in the teaching and learning activities within the curriculum. This team, consisting of Information Science specialists, instructional designers, an educational consultant, staff development professionals and a graphic designer were invited to participate in the project. They were all selected because of their expertise in their specific field.

All participants completed their individual HBDI™ profiles, their profiles were debriefed and all had a better understanding of the Herrmann Whole Brain Model®, their individual and collective strengths as well as areas of lesser preference and the impact these preferences could have on the project. Members were informed that a successful project may occasionally challenge them to stretch themselves outside their comfort zones or to take the lead.

Looking at individual profiles and displaying the profiles in a composite provides helpful information; how people think is somehow related to what they prefer to do, and the things that they prefer to do are things that they probably like to do, and therefore we would get better performance and high motivation as well (Herrmann 1996:30; Wysocki 2002:87).

1.3.3 Results of project team profiles

Figure 2 is a reflection of the composite profile of the project team. The composite profile of the team does not focus on the individual contributions of each member, but on the pattern displayed by the whole team.
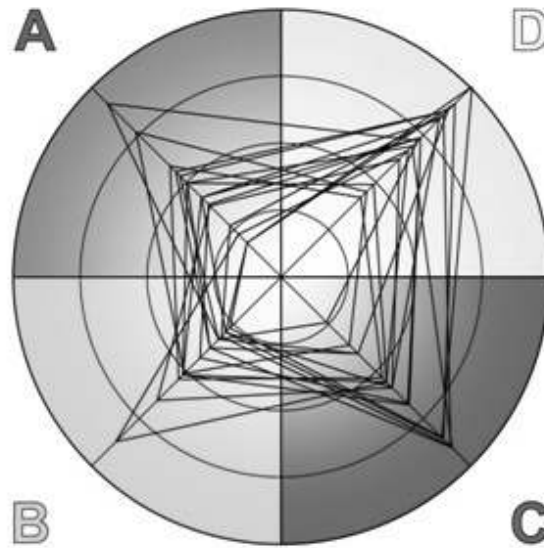

Figure 2 Composite project team profile

Figure 3 shows the 15 team members' group average. Simply the average of the data provides a less cluttered presentation of the team profile within a single kite.
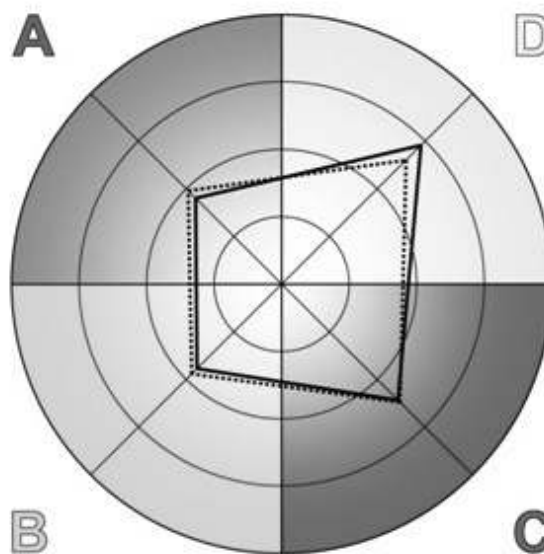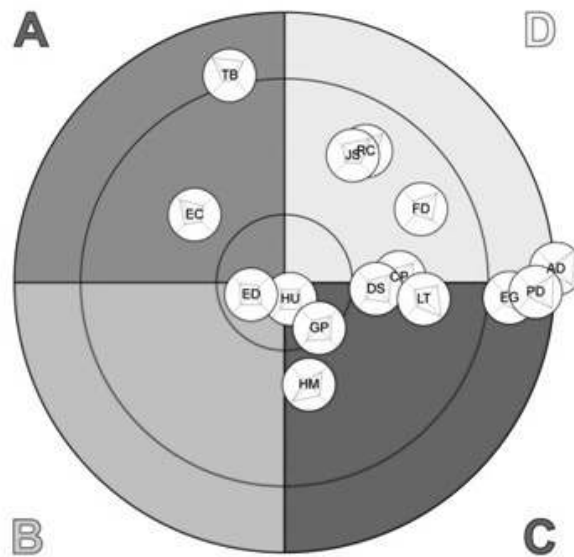

Figure 3 Project team average profile

Figure 4 is the preference map of the project team, portraying an individual's preference as a single data point on display on one graph. This information assists in terms of evaluating the team's strongest preference, in this case for C- and D-quadrant thinking.


Figure 4 Preference map of the project team

1.3.4 Results of design team profiles

The next step was to look at the design team in terms of their profiles. They are a project team on their own but as a sub-team they form an integral part of the multidisciplinary team. The team of 8 members in total represented by the instructional designers, graphic designer and the education consultants, was responsible for the design of the learning material decided on by the project team.

When the individual profiles of the team members were put into a composite profile they indicated much more diverse thinking – and therefore the blind spots needed to be highlighted early in the project to avoid possible conflict. A cross-section of the individual profiles clarified the necessity for a strong B-quadrant as well as for the analytical A-quadrant for the team members. It also pointed out the possible conflict that could arise between a too strong D-quadrant versus B-quadrant thinking as seen in Figure 5.
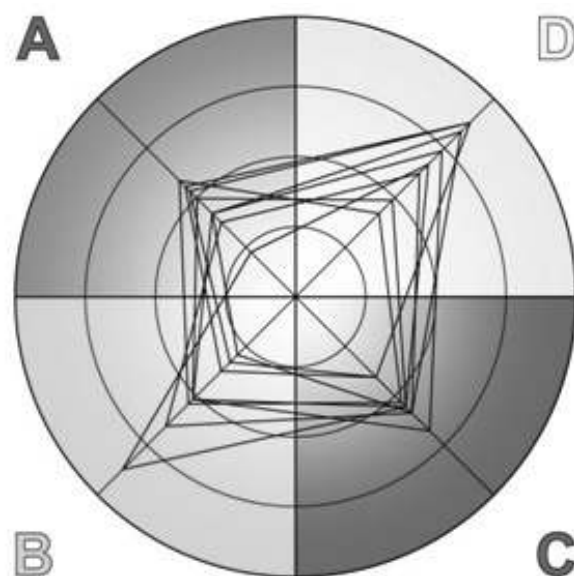
Figure 5 Composite profile of the design team

Figure 6 shows the group average and indicates, as expected, a more homogeneous team in terms of thinking preferences with the tilt of the kite towards C- and D-quadrant thinking.
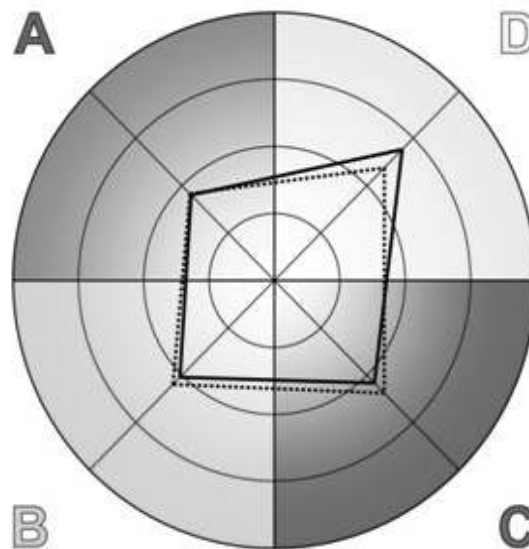

Figure 6 Group average of the design team

The preference map of the team in Figure 7 clearly demonstrates blind spots for quadrants A and B thinking.
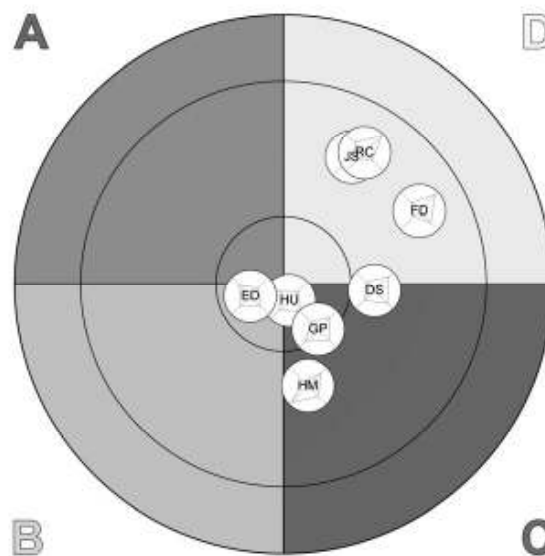

Figure 7 Preference map of the design team

1.3.5 Whole Brain Creative Process©

The Whole Brain Creative Process© (Herrmann 1996:217) was used during Phase 3 to bring about task congruence within the project team during the design and development of new Whole Brain learning activities for each chapter of the book. This process consisted of the following elements: creating interest, preparation, incubation, illumination, verification and application as illustrated in Figure 8.

The Whole Brain Creative Process© as illustrated in Figure 8 was implemented to design whole brain learning material for each chapter.
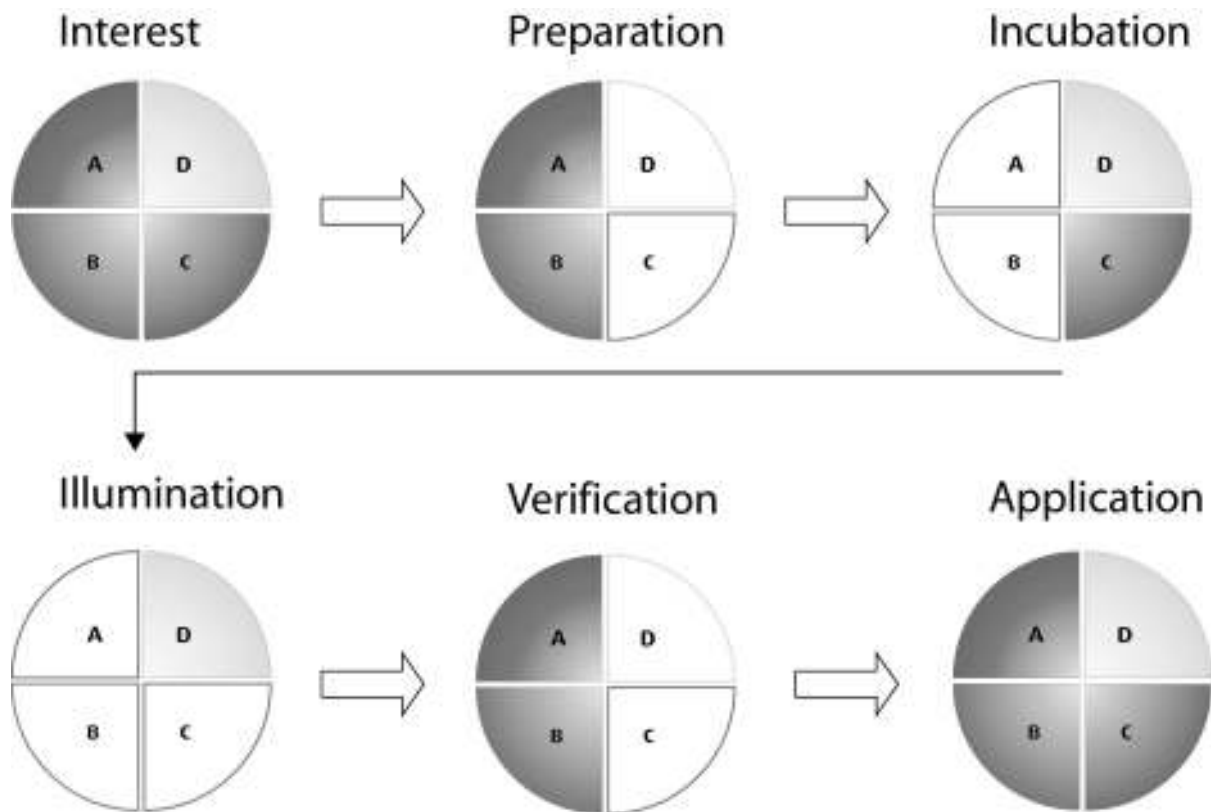
Figure 8 The Whole Brain Creative Process

2 Discussions

2.1 Why projects fail

The root causes for projects to fail have been documented mainly as inadequate communication, ineffective use of the project team itself and inappropriate project management processes (Wysocki 2002:9). Acknowledging these aspects and addressing them upfront really makes a difference.

The enthusiasm with which teams operate depends mainly on the collective behavioural characteristics of the team itself. Team members should be made aware of the fact that if the team's preference is, for example, for very analytical types of activities and the project they are involved in requires a great deal of creativity, or the team members favour creative thinking and the project requires the implementation of a product or system, the team might not get the results they expect. Frustration levels could be very high – sometimes even to the point of failure of the project – unless the team members are made aware of their thinking preferences and avoidance areas in advance of executing the task (Wysocki 2002:87).

The project leaders realised that in order to ensure successful delivery of the project, the emphasis should be on innovation and collaboration, which means the project itself will have a strong representation within the C- and D-quadrants. This emphasised the need for team members with a strong thinking preference associated with these quadrants.

2.2 Team profile

A successful project needs to deliver, not in terms of technical (academic) expertise only, but in terms of balance. Balance implies that all four quadrants are used to serve the purpose of the project. The kite for the average team profile (Figure 3) aligns very well with the envisaged project requirements, namely that of strong C- and D-quadrant thinking.

2.3 Identifying possible conflict areas

Comparing the two composite maps (Figures 2 and 5) reveals the following possible conflicting areas:

- The design team's preference to use D-quadrant thinking as a natural preference will stimulate new innovative ideas within the project. The strong B-quadrant thinking of one individual within the team could be a challenge for conflict, especially in the early stages of the project when ideas have to be generated, as this individual would like to think processes, delivery and detail on execution level while the majority of the team will be generating ideas.

• Another challenge during the initial stages of brainstorming would be to satisfy the A-quadrant's analytical fact-based thinking that might be activated too quickly by analysing innovative ideas.

2.4 Identifying blind spots

The preference map of both teams (Figures 4 and 7) indicates that there is no strong representation of B-quadrant activities. The project team's challenge would certainly then be for B-quadrant thinking – the planning, organising, doing administrative tasks, making sure things get done, documenting the decisions made, delivering products within time frames, ensuring that the team delivers what has been agreed on. The team's lack of a preferred single dominance for B-quadrant thinking was highlighted as its blind spot for the project and each member needed to commit to stretching into B-quadrant thinking. This calls for several personal and interpersonal skills among those who contribute to the planning and delivery.

Collectively the team possessed all the requisite competences and skills to accomplish the project and this could only be done if we relied on our strong interpersonal collaboration skills. The success of the project was founded on open discussion on a regular basis and the sessions were used to discover possibilities and alternatives and to provide feedback in a meaningful and encouraging way. This was a re-enforcement for especially the design team to focus and deliver on the next assignment.

2.5 The creative process

Kao (1991:14) says that creativity may be defined as "a human process leading to a result which is novel (new), useful (solves an existing problem or satisfies an existing need), and understandable (can be reproduced)". Despite the strong interpersonal collaboration skills present within the team it was necessary to develop a process to allow for creativity and innovation to address the need for an enhanced curriculum.

McFadsean (2002) describes the levels of attention needed within a group to stimulate creative problem solving as a mix of attention to a task, the meeting process, the team structure, the team dynamics and trust within a team. According to McFadsean a group that portrays all of the afore-mentioned is described as a Level 5 group (highest level). The rest of this article endeavours to illustrate how the application of the Whole Brain Model® was utilised to address the task meeting process and to ensure team trust during the design and development of learning material to enhance the quality of the first year Information Literacy module.

2.6 Whole Brain Creative Process©

2.6.1 Step 1: Interest

The interest of individual team members depends on their thinking preferences. It is therefore necessary to ensure that all quadrants are addressed in the initial phase to spark the interest of each individual. Facts are important to individuals with A-quadrant dominance, form is important to people with B-quadrant dominance, participation to people with a C-quadrant preference and the future is important to individuals with a D-quadrant preference.

Interest (Figure 8) was primarily created by having members in the design team who are particularly interested in addressing the thinking preferences of students in general and in applying the Whole Brain Model® to address the thinking preferences of students in particular. Instead of assigning only a single instructional designer (as was customary) to the project, all instructional designers who wanted to participate (a total of 6) were appointed with a view to ensuring that all thinking preferences (a "whole brain") were present in the design team.

At the start of the project the analysis of the student feedback questionnaire provided a strong "spark" for individuals with A-quadrant dominance to convince that change was needed. Secondly, examples for Chapter 4 based on the whole brain concept were demonstrated to activate participants' D-quadrant thinking; thirdly, the full design team was present indicating the support the lecturers had for the project. The information specialists were convinced that it is possible to teach Information Literacy in a Whole Brain manner and understood that there was a team committed to supporting them in this endeavour.

Team members with a preference for the B-quadrant were impressed by the detail contained in the textbook (form). Individuals with C-quadrant dominance were interested in the students' participation and the fact that they could assist in advancing the learning environment for students, while the individuals with D-quadrant dominance were inspired by the idea of influencing the future of the IL module and hopefully a large number of students' learning. The whole team was convinced that the use of the Whole Brain Model® to design learning activities was possible and would add value to the module.

The innate interest of the team members in the project was enhanced by the demonstration of Whole Brain interventions. This ensured active participation of all team members throughout the different stages of the project, each entailing re-working of the next chapter.

2.6.2 Step 2: Preparation

The preparation (Figure 8) focused mainly on left brain thinking preferences. The design team analysed the current status of the module with regard to what existed in terms of learning material, what challenges the module presented and what strategies were followed to present the module. This process consisted of the data analysis of the focus group interviews and surveys submitted by the students and assistant lecturers.

The chapters identified by students as the most problematic were deemed to be the highest priority. The research results indicated that Chapter 4 (*Constructing a search query*) was perceived as the most difficult to understand, with Chapter 8 (*Ethical and fair use of information*) as the most boring. The team determined that Chapter 1 (*Information literacy*) was also a very important chapter to address, as the first lecture had to capture the students' attention and convince them of the academic value of the module. The team worked through the textbook in detail to analyse the content and list possible blended learning activities to enhance each learning opportunity within and outside the class. The above-mentioned processes ensured that task congruence was achieved through defining the problems (McFadsean 2002).

2.6.3 Steps 3 and 4: Incubation and illumination

The team was subjected to two cycles of incubation and illumination which resulted in improving the quality of the product. A brainstorming session with the project team allowed for ideas and input from each member. Consideration of all ideas without analysis or evaluation created a non-threatening environment into which the most timid participant eventually ventured to provide input. This approach supported the building of trust among team members that is essential if new tools or techniques are to be implemented (McFadsean 2002).

Ideas generated during these sessions varied from innovative to adaptive, applying the principal types of problem-solving, namely creativity and innovation (Kirton 1976). Innovative new ideas for activities were sometimes expressed and at other times the team members would build onto an idea mentioned by someone else. All ideas were recorded in an "idea plan" that would be used during the second brainstorming session on a specific chapter.

A second brainstorming workshop was then scheduled for the information specialist responsible for a specific chapter in the book and the design team. Usually at least one week elapsed between the first and second brainstorming session, allowing for an incubation period. The brainstorming sessions functioned as the "illumination phase" which is predominantly a D-quadrant activity because imagination is used extensively. The "incubation phase" involved both the C- and D-quadrants as the ideas created in the D-quadrant were weighed against the effect the activities would have on the students. The second brainstorming session elaborated on the idea plan created for a specific chapter and sometimes used idea plans from other chapters.

2.6.4 Step 5: Verification

During this session the first round of verification was built in and the team analysed and evaluated the ideas for suitability and practicality – using the A- and B-quadrants. The following criteria were used to determine if an idea would be acceptable:

- Suitability to illustrate the outcomes of the chapter
- Suitability for large classes
- Technical requirements to build the activity
- Available skills within the design team
- Time constraints
- Face-to-face class activity
- Online/LMS class activity
- Group/Individual activity
- Homework activity
- Degree to which the activity contributes to assessment of learning.

2.6.5 Step 6: Application

The application phase was mainly concerned with creating and developing an activity. This involved the writing of the text, storyboards, creating visual learning media as well as developing the technical aspects of the activity. Here too, working in an iterative process where the content and prototypes of the activities were shared between the design team and the information specialist resulted in a better product.

The second verification phase was conducted during a meeting where new products were demonstrated and evaluated by all team members. The high level of imagination within the design team had a contagious effect on the rest of the team, resulting in individuals with a predominantly analytical thinking preference to venture into storytelling and scenario creation to convey the content in the textbook in a way that can assist students with thinking preferences in the C- and D-quadrants. This "feedback loop" built into this system revealed the enhanced quality of the product resulting

from the process. The team received feedback on the quality with a view to keeping them interested, motivated and focused to ensure the success of the project. Timeous delivery of these quality interventions also contributed and strengthened the trust relationship within the team.

2.6.6 Critical success factors for the third phase of the project

The success of the third phase can be contributed to the following factors:

- A heterogeneous team with representation from a variety of subject field knowledge, skills and thinking preferences.
- An understanding of the Whole Brain Model® and its implications for team work as well as for the design of learning activities.
- Buy-in into the application of the Whole Brain Model® in designing learning activities.
- Using the Whole Brain Creative Process© ensured that the momentum of the project was kept.
- Quality products were delivered on time.
- End-user involvement (academics as well as students) from the onset.

3 Conclusion

When we learn to cultivate the four "thinking styles" and harness their collective energy the result is Whole Brain Technology – the powerful key to strategy, productivity and creativity in education, business or project management.

The value of the collaboration and co-operation of an inter-disciplinary team can be seen in the following:

- *Sustainability of the project*. Previous attempts at similar collaboration failed; by using a mental model the project is sustainable and the team is delivering high quality products as illustrated in this paper.
- *Enhanced creativity*. The process empowered lecturers to think outside the box. Experts in their various fields were stretched in terms of their level of excellence – they developed and created new teaching and learning material that transformed their teaching scholarship. Their lesser preferred modes of thinking were activated and in doing so developed their latent potential in the process.
- *People spontaneously took up responsibility for and ownership of their roles and deliverables*. Letting the team down was never an option. Ultimately the process created positive staff morale and motivation.
- *Being role models for other faculties*. Requests have been made to assist in facilitating inter-disciplinary collaborative processes in other faculties to create better teaching and learning material.
- *Stimulus for research*. A vibrant culture of inclusion is emerging. New possibilities are recognised in all the different fields of research. The project attracted postgraduate students from diverse fields not only within the project but also from other disciplines within the University. And this ultimately will benefit not only the project but the entire research output of the departments involved.

People buy into ideas, interventions or projects that they participate in – each with his/her individual profile. The best results can be obtained through collaboration within a team since a project and its underpinning problems are approached from different points of view. A project leader can take the Whole Brain Mental Model a step further by creating profiles for each of the different *phases* of a project since each phase of the project may require a different sub-team profile. Therefore, requiring a team using different thinking styles in each phase may contribute to the most effective outcome or product (Wysocki 2002:175). The concept of balanced whole brain learning once understood becomes an irresistible tool in any project management team.

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