Bridging the Gap between Teachers' Approach to Teaching and Students' Approach to Learning

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ABSTRAK

Penelitian ini menjelaskan upaya untuk menjembatani kesenjangan antara pendekatan siswa dalam pembelajaran yang dikembangkan dari model Curry tentang "onion" dengan pendekatan guru dalam pengajaran yang dipengaruhi oleh konsep tentang pengajaran dan pembelajaran. Dengan menggunakan kajian pustaka, penelitian ini mengidentifikasi jenis-jenis strategi pembelajaran yang diyakini bisa menjembatani kesenjangan antara gaya belajar siswa dan gaya mengajar guru. Berdasarkan sistem 4MAT yang dikembangkan oleh McCharthy, penelitian menemukan lima jenis hubungan atau *cluster* yang berkaitan dengan pembedaan lima gaya mengajar. Setiap gaya menggambarkan serangkaian instruksional dan strategi pengajaran yang bisa dilakukan untuk memenuhi kebutuhan setiap siswa serta tiga cara untuk mengurangi kesenjangan antara gaya mengajar guru dan kebutuhan siswa.

Kata kunci: gaya pemrosesan informasi, gaya kepribadian kognitif, gaya mengajar, McCarthy's 4MAT System.

In the educational field, learning styles have been the concern of many researchers who are interested in investigating how learners interact with their environment. They have conducted researches with several objectives such as to improve teaching styles, to meet a student's learning style, and to assist students to adapt their existing learning strategy to their new learning strategy as a result of environmental changes. Many studies related to individual learning styles suggest that understanding students' perceptions about their academic environment and their preferences for their instruction can allow teachers to select and adapt suitable teaching strategies to improve students' needs in learning. Hence students can achieve satisfying outcomes.

Recently, pedagogical scientists have transformed their teaching approaches by employing a variety of instructional strategies to match the needs of different learning styles. However, based on learning style theories, it is believed that individual learners have very different learning styles. Thus, by considering both perspectives (teachers' perspectives and students' perspectives), this research investigates what kinds of teaching strategies will meet the gap between teaching styles and learning styles.

Learning styles are much related to "cognitive, affective, and psychological characteristics" (Kratzig & Arbuthnott, 2006: 238) that are considerably distinctive from one individual to another (Williamson, and Watson, 2006, para 1). Keefe and Ferrel have defined a learning style as:

> a complexus of related characteristics in which the whole is greater than its parts. Learning style is a gestalt combining internal and external operations derived from the individual's neurobiology, personality and development, and reflected in learner behaviour (Keefe & Ferrel, 1990: 16, cited in Robotham, 1999, para 1).

If teachers recognize their students' individual learning styles, this assists students' participation and accomplishment. If students understand their learning preferences, they will tend to learn and use strategies they prefer, perform better educationally, and stay in an educational learning situation longer to enhance their knowledge. Hence, the probability in achieving their desired outcomes is better (Woolhouse and Blaire, 2003: 258).

To understand learning styles more easily, Curry (1983) developed a model that allows researchers to investigate learning styles from three perspectives (Williamson and Watson, 2007, p 62). She described the three different perspectives as three layers linked in the layers of an onion. They are: Instructional Preference, describes the outer layer, Information Processing Style illustrates the middle layer, and Cognitive Personality Style depicts the core layer (Price, 2004: 281). This perspective is shown in Figure 1.

Cognitive personality style relates to the learner's use of the right or left hemisphere of the brain. By considering this, it is important to consider the concepts related to the whole brain functions affecting learning styles because such concepts provide a foundation for linking the gap between "the unique individual learner and the design and delivery of the learning" (Herrmann-Nehdi, n.d: 1). Based on Kolb's work and associating right/left brain hemispheric functioning, McCarthy (1990) developed the 4MAT system, providing four learning styles, with each style reflecting the characteristics of four separated quadrants associated with brain hemispheric functioning (Wheeler, 1988, cited in Ballone., and Czerniak, 2001, para 14). The model is described in Figure 2.

According to McCarthy (1990), this model is related to the brain functions. She believes that a combination of perceiving and processing information affects someone's cognitive styles (cited in Hainer, 1999: 6). She suggested that because the two hemispheres of the brain process information differently, the two parts of the brain

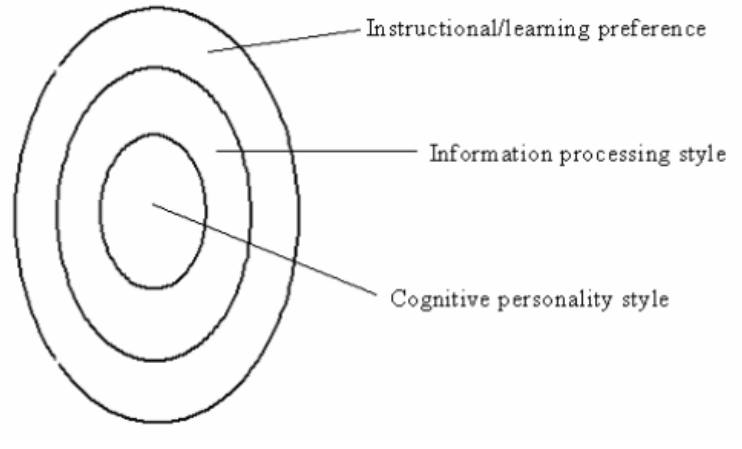

Figure 1: Depiction of Curry's Learning Style Model
(Source: Curry, 1983, p. 19, cited in Price, 2004, p. 682)

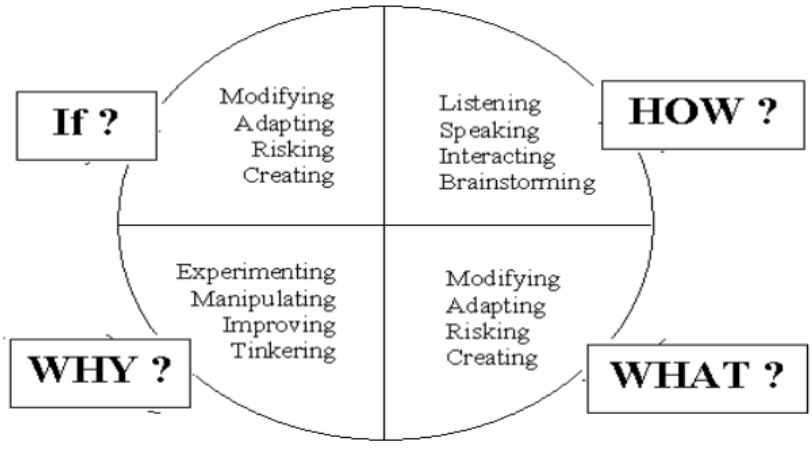

Figure 2: Skills of the four learning styles
(Source: Huitt, W. (2000). Individual differences: The 4MAT system. Educational Psychology Interactive. Valdosta, GA: Valdosta State University from http://chiron.valdosta.edu/whuitt/col/instruct/4mat.html)

share the processing of information equally in learning (McCarthy, 1980, cited in Hainer, 1999: 6).

There are four major learning styles developed by McCarty in the 4MAT system in which each learning style is associated with the two hemispheric brains. Left-brain learners are logical, rational, sequential, serial, verbal learners. Right-brain learners are intuitive, emotional, holistic, parallel, and tactile learners (Huitt, 2000, para 3). Clearly, eventhough the two parts of brain have different roles in processing information and every person has different styles from others in tending to use the part of the brain, both parts of the brain are very important in processing information. So, McCarty considered the whole brain in addressing cognitive style in processing information.

McCarthy (cited in Huitt, 2000, para 3) suggested that concrete-random or imaginative learners want to know "why" they should be engaged in this activity and prefer to use listening, speaking, interacting and brainstorming. The abstract-sequential learners want to know "what" to learn. They like to use observing, analyzing, classifying and theorizing to approach their learning. The concrete-sequential learners wish to know "how" to apply the learning by involving experimenting, manipulating, improving and tinkering to conduct learning. The abstract-random learner asks "if" this is correct, how I can modify it to make it work for me. In response this question, the learners prefer modifying, risking and adapting to address their learning.

McCarthy realized that although students differ in the way they depend on either their left-brain or their right-brain, she urged that utilizing the whole brain model increases meaningful learning for students. With regard to cognitive styles, she acknowledged that learners tend to respond the four types of questions (why, what, how, and what if) in a different way relied on their tendency to use every the part of brain. In the other words, each learner has different preferences in responding to a question depending on the learner's tendency to use different parts of the brain. Figure 3 displays the 8 instructional events proposed by this system. In Figure 3, McCarthy summarized how learners who have different cognitive styles will respond the four types of questions (cited in Huitt 2000, para 5).

Nisaken (2001, para 3) also suggested the preferences for each learning style of students.

By the same logical thinking, Herrmann-Nehdi (n.d: 2) described the two upper hemispheres as

Table 1: The Eight Instructional Events of the 4MAT System
(Source: Huitt, W. (2000). Individual differences: The 4MAT system. Educational Psychology Interactive. Valdosta, GA: Valdosta State University. from http://chiron.valdosta.edu/whuitt/col/instruct/4mat.html)

STEP	LEFT MODE	RIGHT MODE
	WHY? (Motivate and Develop Meaning)	
1		Create an experience (CONNECT)
2	Analyze/reflect about the experience (EXAMINE)	
	WHAT? (Reflection and Concept Development)	
3		Integrate reflective analysis into concepts (IMAGE)
4	Develop concepts/skills (DEFINE)	
	HOW? (Usefulness & Skill Development)	
5	Practice defined "givens" (BY)	
6		Practice and add something of oneself (EXTEND)
	IF? (Adaptations)	
7	Analyze application for relevance (REFINE)	
8		Do it and apply to more complex experience (INTEGRATE)

Dynamic Learners

Like
- Interdisciplinary Approaches
- Open Ended Questions/Activities
- Flexible Demands
- Looking For Patterns
- Self-discovery Projects

Dislike
- Assignments Without Options
- Repetition and Drill
- Reflecting: Inactivity

4

Innovative Learners

Like
- Group Work
- Group Grading
- Pass/Fail Grading
- Self Evaluation
- Unobtrusive Observation
- Participation Grading
- Time To Reflect

Dislike
- Timed Tests
- Computer Assisted Instruction
- Debated
- "Just Do It"

1

3

Using Knowledge

Like
- Field Trips, Labs
- Hands-on Activities
- Mobility & Concrete Materials
- Skills Oriented Evaluation
- Practical Applications

Dislike
- Memorizing
- Writing Assignments
- Group Work/Grading
- Peer Evaluation Involving "Feelings"
- Being Given Answers

2

Analytic Learners

Like
- Comments on Papers/Tests
- Written Tests
- Essays
- Multiple Choice Tests
- Concepts and Ideas
- Collecting Data

Dislike
- Role Playing
- Pass/fail Grading
- Subjective Tests
- Group Grades

Figure 3: The Summary of 4MAT Evaluation Techniques of Four Learning Styles (Source: Niskanen (2001) from http://www.geocities.com/jeniskanen/4mat.htm)

being associated with cognitive, cerebral styles and the two lower hemispheres with instinctive and emotional modes. Furthermore, she claimed that the left hemispheres take responsibility for thinking processes, that is, more logical, analytic, quantitative, factual and also more planned, organized, and sequential mode processes. Conversely, the right hemispheres use thinking process in terms of more synthesizing, integrating, holistic, intuitive and also more interpersonal, emotional, kinesthetic and feeling modes (Herrmann-Nehdi, n.d: 2).

Research conducted by Herrmann-Nehdi (n.d) reveals that there are different instruction and delivery approaches to enhance and assist learning in order to satisfy each of the four quadrant typical students. It can be summarized in the Figure 5 (p. 4).

Based on Curry's model (1983), Kolb (1984) developed the concepts of two fundamental concepts of Curry's middle layer in which the layer embraced theories of how learning is impacted by social interaction (Cassidy, 2004, cited in Williamson & Watson, 2007: 63). The notions are

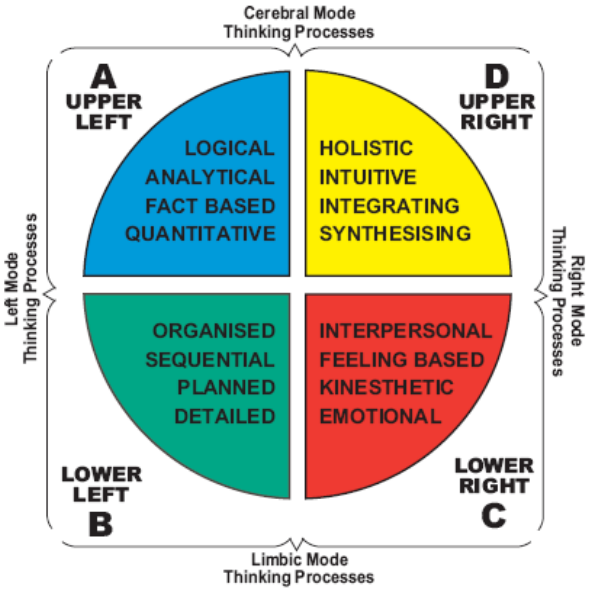

Figure 4: Whole Brain Model (Source: Herrmann International, 2000, p. 2)

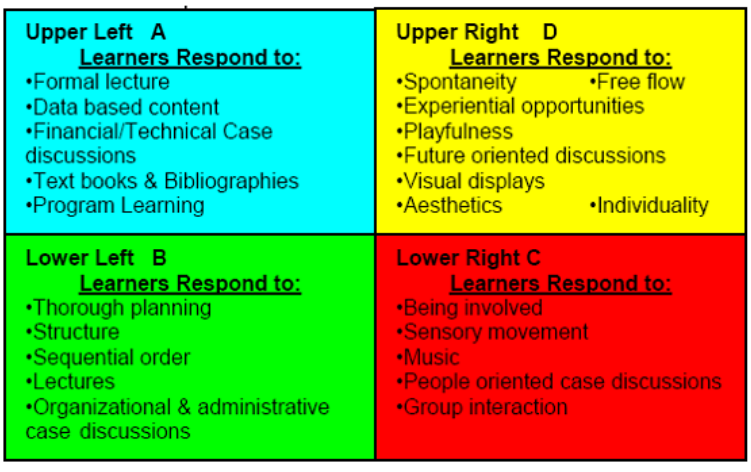

Figure 5: Design & Delivery Approaches for the Specialized Modes of the Four Quadrants (Source: Herrmann-Nehdi, n.d, p. 4)

"how learners grasp a new experience or receive new information… [and]…how learners process or transform the learning experience" (Claxon & Murrell, 1987, cited in Williamson and Watson, 2006, para 5). Kolb established an experiential learning cycle whereby learners must address the four stages in order to achieve their desired outcomes effectively (1984, cited in Hatkin, et al, 2002: 40-41, cited in Woolhouse and Blaire, 2003: 259). The cycle incorporates four adaptive styles of learning: concrete experience/learning from feeling, reflective observation/learning by watching and listening, abstract conceptualization/learning by thinking, and active experimentation/learning by doing (cited in Hainer, et al. 1990: 4-5). In the same way, Honey and Mumford categorized learning styles into four styles: activist, reflector, theorist and pragmatist (1986, cited in Woolhouse & Blaire, 2003: 258). Furthermore, Honey and Mumford joined up the Kolb model with their Model to create a 'diamond' shape. The diamond shape contains four quadrants in which each quadrant has characteristics associated with the combination of styles. It is described in Figure 6.

Arant, Coleman, and Daniel (2002, cited in Williamson & Watson, 2006: 8) suggest that there are implications of the knowledge of learning style in a class room (2006: 8). They believe that convergers will be satisfied when they face teaching methods that afford decision-making, problem solving, and hands-on work. Teaching to divergers, teachers should accommodate cooperating and

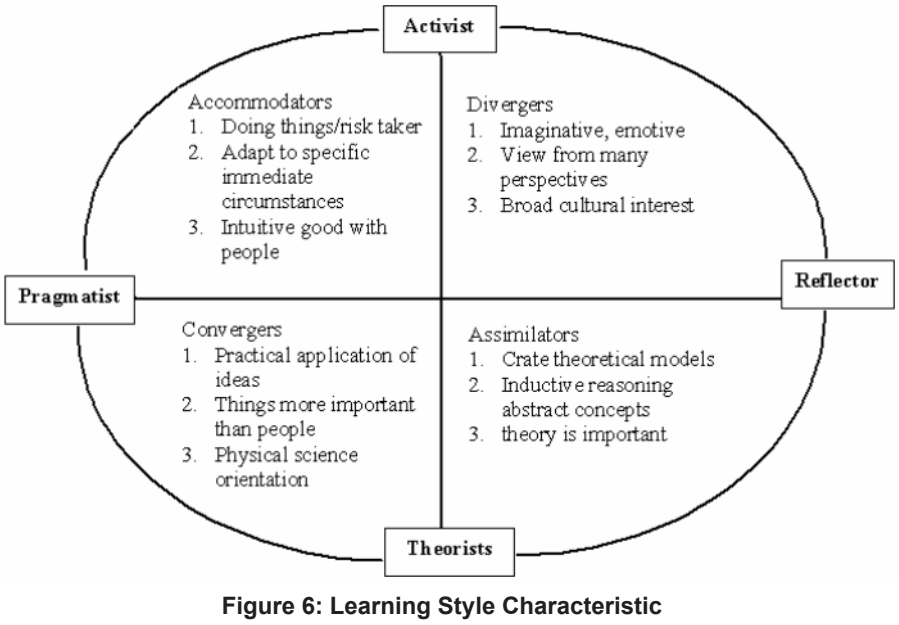

Figure 6: Learning Style Characteristic (Source: Woolhouse and Blaire, 2003, p. 261)

brainstorming. Assimilators will favor the creation of a model of theory, and they will enjoy the lesson if teachers encourage them to create projects for credit. Finally, accommodators will be happy with assignments that let them become involved with the discovery of learning, activities, and projects.

Students' awareness of their cognitive and learning styles will be reflected in their instructional/learning preference. When they feel that the characteristics of instruction match with their style, the effectiveness of the instruction will be achieved. Learning environments that provide enjoyment for students will encourage students to learn more effectively. In contrast, when students feel inconvenience during learning because of mismatching instruction, they will be frustrated and they will reject the learning environment (Kolb, 1976, cited in Robotham, 1999, para 14). However, it is necessary to provide a deliberate mismatch between learning style and instructional style to achieve long term benefits (Kolb 1984, cited in Robotham, 1999, para 14). Furthermore, he believes that

> The aim is to make the student self-renewing and self-directed; to focus on integrative development where the person is highly developed in each of the four learning modes; active, reflective, abstract and concrete. Here, the student is taught to experience the tension and conflict among these orientations, for it is from these tensions that creativity springs (Kolb, 1984, cited in Robotham, 1999, para 14).

Gregorc pays attention to what extent the mismatch between learning style and instructional styles benefits students. He suggests that boredom can be faced by students because "when teaching and learning styles are matched over long periods of time, teachers and learners fall into a comfortable learning pattern" (1979, cited in Williamson & Watson, 2007: 66) and eventually this situation does not necessarily challenge students. He recommends that great mismatching may frustrate students and it can cause students to become reluctant and angry and avoid learning. On the other hand, somewhat mismatched learning and teaching styles will encourage teachers and students to enjoy new experience and it may provide good learning experiences (1979, cited in Williamson & Watson: 66).

According to Sadler-Smith (1999: 27), there are three groups of learning preferences. They are dependence, collaboration and independence. In terms of dependence, learners prefer teacher-directed, highly structured lecturing with open-end assignments set and appraised by the instructor. In collaboration, learners like discussion and team work projects, group work assignments and social interaction. Finally, in an independent context, learners enjoy "exercising an influence on the content and structure of learning programs within which the teacher is a resource" (Sadler-Smith and Riding, 1999, cited in Sadler-Smith, 1999: 27).

Moreover, Sadler-Smith (1997, cited in Sadler-Smith, 1999: 28) proved statistically that there is a significant relationship between learning preferences and learning style and approaches to studying. They also proved that there is a significant correlation between "cognitive style and learning preferences for reflective and individually oriented methods" (Sadler-Smith, 1999: 35-36).

It is believed that teaching style is an important notion affecting the outcomes of learners if there is a match between learning style and teaching style. A lot of research has been conducted to explore factors influencing the match/mismatch between learning styles and teaching styles. To investigate teaching style, Butler (1984) defined teaching style as

> A set of attitudes and actions that open a formal and informal world of learning to students. The powerful force of the teacher's attitude toward students as well as the instructional activities used by the teachers shape the learning/teaching experience and require of the teacher and student certain mediation abilities and capacities (Butler, 1984, cited in Reed, 2000:. 5).

Heimlich & Norland (2002) believed that teaching styles refer to the behavior or actions that are shown in the exchange process of teaching and learning. They explained that beliefs and values that educators hold about their own roles and students' role in the exchange, will be reflected in the teaching behaviors (cited in Brown, 2003. para 1).

Pedagogical scientists have not conducted research in teaching styles as much as in learning styles. There are some theories picked from the results of research that still lack agreement about teaching style models and approaches (O'Neil, 1990, cited in Reed, 2000: 42).

Based on teaching orientation, Fox (1983: 153-157) conceptualized five teaching theories. They are transfer, shaping, traveling, growing, and building. Transfer theory is a teaching theory aimed at transferring knowledge from teachers to

students. It is assumed that students are as an empty bowl which waits to accept the knowledge. Shaping theory is an assumption that students are raw material which is ready to be molded to fit a preferred model. The two theories are said to be simple theories, and suggest that teachers see students as passive learners (Rossum & Hamer, n.d, para 6). Traveling theory positions teachers as guides who have a role to accompany students in their exploration of learning and to help students by giving information and instruction in order that students can do certain things or understand certain knowledge. In this theory, students and teachers are active. In Growing theory, teachers must pay attention to the importance of personal development. Teachers believe that their role is as an inspirer, and they assume that students are active learners (Rossum & Hamer, n.d, para 6). The last two theories are classified as developed theories because the theories place students as subjects. Lastly, Building theory, considered as a bridge linking simple theory and developed theory, is conceptualized as "a building of a concept structure, focusing on relationships rather than on separate elements (Rossum & Hamer, n.d, para 7). Teachers provide the blueprint, and students actively contribute to the learning process.

Five perspectives of teaching are also suggested by Pratt (2002), who maintains that teachers should use the perspectives to recognize, articulate, and rationalize their teaching approach in terms of more than one approach (cited in Brown, 2003, para 9). The approaches are transmission, developmental, apprenticeship, nurturing and social reform. In transmission, educators concentrate on content and decide what matter should be learned by students and in what way they should learn it. Teacher will give feedback and direct students if they make errors. In terms of developmental perspective, teachers will direct learners to study in more gradually complicated ways of reasons and problem solving, after they determine learners' prior knowledge. Apprenticeship perspective allows teachers to let students to learn in real work settings. With respect to Nurturing perspective, interpersonal factors of student learning such as listening, getting to understand students, and responding to students' psychological and cerebral needs become the focus of teachers. Finally, in social reform perspective teachers give attention to effects of ideas on the lives of the students (cited in Brown, 2003, para 9).

Many pedagogical scientists have suggested that teachers should understand not only their own styles but also learning styles in order that they can meet learners' needs by adapting their teaching styles (Claxton & Ralston, 1978; Dunn & Dunn, 1979; Cornet, 1983; Marshal, 1991, cited in Reed, 2000: 42). In Figure 7, Based in McCarthy's 4MAT System, Niskanen (n.d, para 4) summarized teachers' roles (as Motivator/Witness, Teacher/ Information Giver, Facilitator/Coach, Evaluator/ Remediator and Resource) and their styles related to the learning styles.

Method

Based on the introduction described above, this research investigates the bridge connecting the gap between students' approach to learning, in terms of three concepts, that is, cognitive style, learning style and instructional preferences, and teachers' approach to teaching, reflecting teachers' conception of teaching and learning. The research will do this by adopting the Trigwell et.al model, which, with a little adjustment can be simplified by employing a certain figure 8, below (Trigwell, Prosser, Waterhouse, 1999: 60):

The questions linking the gap are:

1. Do teachers teach the way they have been taught, or learned best?
2. Do the best learning outcomes happen when there is a match between teaching style and learning style?
3. Can a learner modify his/her learning approach?
4. Can a teacher adjust his/her teaching approach?

In exploring the bridge linking students' approach of learning and teachers' approach of teaching, the writer used literature reviews or inquiries related to learners' approach to learning and teachers' approach to teaching and the interconnection between them. Hence, the writer used documentation techniques produced by other researchers.

Results

Do teachers teach the way they have been taught or the way they learn best?

Research supports the view that educators teach in ways they learned best (Stitt & Gohdes, 2001, cited in Brown, 2003, para 2). It can be

explained that when a teacher succeeded in academic experiences with learning environments in which the teacher was as a center and learners depend on lectures, the teacher will prefer to use the style and he/she will keep his/her preferred styles going and keep repeating them when teaching.

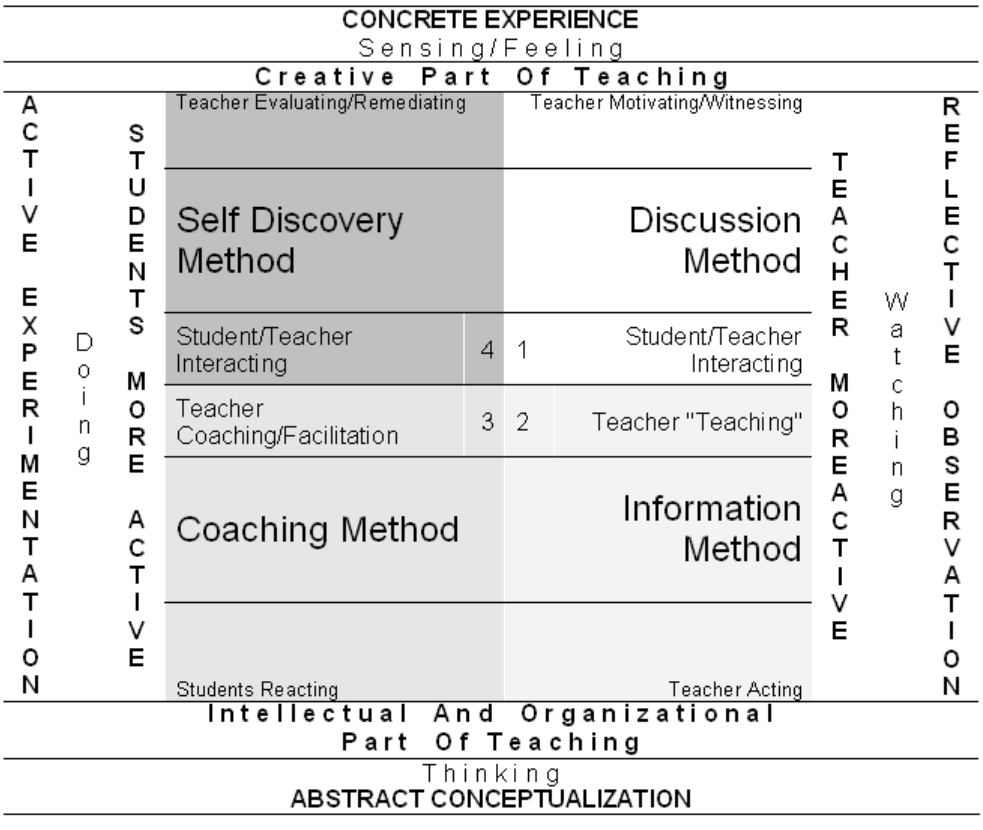

Figure 7: Teachers' Roles and Teachers' Style Related to Learning Styles (Source: Niskanen, 2001. para. 5, from http://www.geocities.com/jeniskanen/4mat.htm)

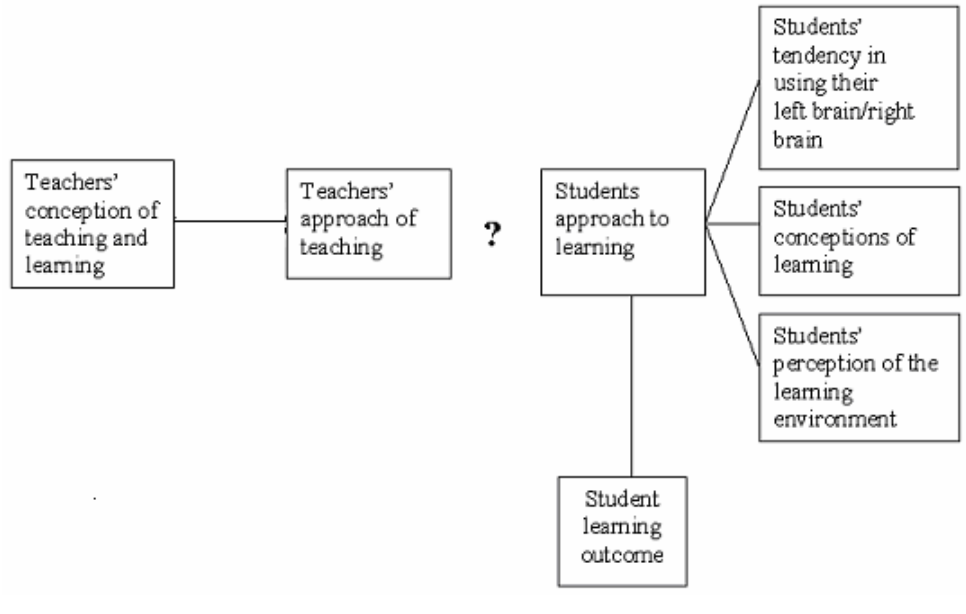

Figure 8: Established links between teachers' conceptions of teaching and learning and students' learning outcomes (Source: Trigwell, Prosser, Waterhouse, 1999, p. 60 with adjustment)

Typically, in teacher-centered styles, teachers are concern with the content of courses, prefer to employ more formal teaching methods, like less learner participation and use more structured class activities (Hayes & Allison, 1997; and Pithers 2001, cited in Brown, 2003, para 2). Teacher-centered styles will work properly if students respond well to teachers' instruction to study given materials and to acquire the specified body of knowledge or skills from the given resources (Caudron, 2000, cited in Brown, 2003, para 2). Conversely, teacher-centered styles will be unsuccessful when context "physical, emotional, and intellectual environment that surrounds an experience and gives it meaning" take part in learning (Brown, 2003, para 2).

Brown (2003) argued that why teachers teach the way they learned is because they are not skilled in education about adult learning principles and they do not understand them. He explained that when teachers are skilled in adult learning principles and experienced with learning styles and constructivism theories that recognize that each individual has different styles in learning and they are likely to approve student centered instructions, although they do not learn best such theories and they do not prefer to do that (Stitt-Gohdes, Crews, & McCannon, 1999, cited in Brown, 2003, para 3). Broad views of how teaching can occur and strong belief about students' need to engage in a learning process encourage teachers to adopt flexible teaching styles to motivate students to become active learners. Teachers are then aware of how both teaching styles and learning styles influence the outcomes of learning.

Briefly, considering learning styles, teachers are not always led to teach in the way they learn best or they prefer to teach. To maximize learners' participation in improving their knowledge, teachers should enrich their views about the exchange process of knowledge and they should have strong beliefs about students' learning needs. Teachers sometimes have to adopt new styles/approaches to encourage students to become active learners.

Do the best learning outcomes happen when there is a match between teaching style and learning style?

Many pedagogical scientists suggested that a match between teaching styles and learning styles improves students' motivation and achievements (Sadler-Smith, 1999: 30). By using the 4MAT System, there is evidence that students display significantly better performance when there is a match between learning styles and learning environment preferences (or teaching style as Cafferty examined) than when a mismatch occurs (MacMurren, 1985; Pizzo, 1981; Cafferty, 1981; Krimsky, 1981, cited in Ballone & Czerniak, 2001: 6).

Because different people have different tendencies in terms of using different parts of the brain, teachers should be aware of oversimplification. This circumstance cannot allow teachers to adopt only one type of teaching strategies.. In other words, teachers need to have adaptable approaches to the instructional tasks they set to address the distinctive style preferences of learners (Nuckles, 2000; Pithers, 2001, cited in Brown, 2003, para 5).

Based on McCarthy's 4MAT System summarized in Figure 7, teachers can develop instructional sets by addressing the different learning preferred styles of students. Teachers can group students' learning styles into four clusters based on learning preferences. This following figure shows teaching methods associated with each cluster of teaching and learning styles.

Can a learner modify his/her learning approach?

Based on Figure 7, it implies that teachers cannot fit their teaching style perfectly to all learners' preferences. In other words, there is still mismatch between learning styles and teaching styles; therefore, students should be able to adjust their learning styles. Pithers (2002) suggested that because cognitive styles may not be a rigid construct and can be influenced by several factors such as age, educational level and motivation developing over the long term, there is a possibility for individual learners who have field-dependent cognitive styles to change their cognitive style through training (cited in Brown, 2003, para. 6). Zhang (2002), proposed that thinking styles are flexible depending on the level of cognitive development, and cognitive development can be improved by pushing learners to engage in a diversity of thinking styles (p. 191). Over a continuing process of learning happening over their life span, and through the diversity of teaching styles faced during learning in a variety of circumstances, learners may be able to change their cognitive style. They are accustomed to facing the mismatch between teaching styles and

their preferences, so that they are challenged to become better all-around learners by "investigating extra effort in underdeveloped or underutilized styles" (Delahoussaye, 2002, cited in Brown, para. 5). A little mismatch between teaching styles and learning styles will help students to increase their ability to learn what is necessary to deal with situations associating with a range of varied learning requirements (Hayes & Allison, 1997, cited in Brown, para 6). However, it also should be considered by teachers that a large mismatch will frustrate learners.

Can a teacher adjust his/her teaching approach?

Modifying teaching style to approach learning style is not easy because the teacher has to accept the idea of change. He/she must transform his/her thinking about the learners' role in the learning environment (Brown, 2003, para. 7). Grasha (2002: 3) urged that it requires teachers to be willing to master the skills in employing teaching methods. Teachers must know their roles as motivators, models (teachers), coachers, and evaluators. They must be prepared to work together effectively with learners and to teach them how to run the relationship effectively. Finally, teachers must be willing to teach students how to learn in new ways to meet the teacher's new approach. If the teachers have a strong belief about the needs of students to engage in the teaching-learning process, and they have broad knowledge about teaching methods, eventually, they will have the capability to adjust their teaching approach.

Conclusion

A great deal of research has revealed that the uniqueness of different teaching and learning styles can create a gap in the exchange process of

Table 2: Teaching Methods Associated with Each Cluster of Teaching and Learning Styles (Adapted from McCarthy's 4MAT System retrieved from Niskanen, 2001. para. 5, from http://www.geocities.com/jeniskanen/4mat.htm and from Heiner at al. 1990, p. 9, from http://www.ncla.gwa.edu/pubs/pigs/pig2.html)

Cluster 1	
Learning styles will be met	1. Concrete Experience learners who like to employ sensing / feeling 2. Reflective observation learners who like to employ watching
Class environment	Student and teacher interaction (Student and teacher are active together)
Learning Method	Discussion
Teaching role	Teacher as motivator
Instructional sets "Why" / Activating Knowledge	
1. Favoring right brain mode	Create the experience
2. Favoring left brain mode	Reflect on the experience
Cluster 2	
Learning styles will be met	1. Reflective Observation learners who like to employ watching 2. Abstract Conceptualization learners who like to employ thinking
Class environment	Teaching acting (Teacher is more active and student is more passive).
Learning Method	Teaching Factual Information (lecturing)
Teaching role	Teacher as informer (teacher)
Instructional sets "What" / Gaining Knowledge	
1. Favoring right brain mode	Integrate reflections into concepts
2. Favoring left brain mode	Present and develop theories and concepts
Cluster 3	
Learning styles will be met	1. Abstract Conceptualization learners who like to employ thinking 2. Active Experimentation learners who like to employ doing
Class environment	Student reacting (student is more active)
Learning Method	Learn By Practice / Coaching method
Teaching role	Teacher as facilitator
Instructional sets "How"/ Using Knowledge	
1. Favoring right brain mode	Personalize the information
2. Favoring left brain mode	Practice and reinforce new materials
Cluster 4	
Learning styles will be met	1. Active Experimentation learners who like to employ doing 2. Concrete Experience learners who like to employ sensing / feeling
Class environment	Student and teacher interaction (Student and teacher are active together)
Learning Method	Do Something Personal With New Knowledge / Self discovery method
Teaching role	Teacher as evaluator
Instructional sets "If" / Applying Knowledge	
1. Favoring right brain mode	Do it and share with others
2. Favoring left brain mode	Develop a plan for applying new concepts

knowledge. When there is no gap between teaching styles and learning styles, those styles can match. Conversely, when there is a gap between those, there is a mismatch. Many researchers have proved that the shorter the gap the better the students' performance, and the wider the gap the worse the students' outcomes. To meet students' preferences to learn, McCarthy's 4MAT System provides instructional sets to address the uniqueness of learning styles. The system groups teachers and learners into four typical teacher and learner groups, in which teachers and learners can utilize particular teaching methods, learning preferences, and environmental settings. The uniqueness of learning styles and teaching styles affects the difficulty in reducing the gap. There are some ways to reduce the gaps. Firstly, teachers should not only teach students the way they themselves have been taught or learn best, but also to expose them to ways that reflect a variety of teaching styles. In this effort, teachers must have broad views about teaching and learning styles and strong belief about students' need to actively engage in the teaching/learning process. Secondly, learners can adjust their learning styles through training or life experience in learning. Thirdly, teachers can adjust their styles through changing their beliefs about learners' role, mastering knowledge about teaching and learning, and being prepared to help students to do such activities associated with the newly adopted teaching styles.

REFERENCES

Ballone, L.M. & Czerniak, C.M. 2001. "Teachers' belief about accommodating students' learning styles in science classes." In *Electronic Journal of Science Education*, 6, 2, n.p. Retrieved May 5, 2007, from http://www.wolfweb.unr.edu/homepage/crowther/ejse/balloneetal.pdf

Brown, B.L. 2003. "Teaching style vs. learning style." In *Clearinghouse on Adult, Career and Vocational Education*, 26. Retrieved May 10, 2007, from Eric: Educational Resources Information Centre, from http://www.cete.org/acve/docs/mr41.pdf.

Fox, D. 1983. "Personal theories of teaching." *Studies in Higher Education*, 8, 2, 151-165. Retrieved May 15, 2007, from http://ingentaconnect.com/connect/routledg/03075079/v8n2.

Grasha, A.F. 2002. "Teaching with style: the integration of teaching and learning styles in the classroom." In *The Professional & Organizational Development Network in Higher Education*. Retrieved May 20, 2007, from http://teaching.uchicago.edu/pod/grasha.html.

Hainer, E.V., et all. 1990. "Integrating learning styles and skills in the ESL classroom: an approach to lesson planning." In *NCBE Program Information Guide Series*, 2, Summer, 1-31. Retrieved May 20, 2007, from http://www.ncela.gwu.edu/pubs/pigs/pigs2.htm

Herrmann-Nehdi, A. (n.d). "Training with the Brain in mind: the application of brain dominance technology to teaching and learning." Retrieved May 1, 2007, from Thomas Gale Data base.

Huitt, W. 2000. "Individual differences: The 4MAT system." In *Educational Psychology Interactive*. Valdosta, GA: Valdosta State University. Retrieved May 1, 2007, from http://chiron.valdosta.edu/whuitt/col/instruct/4mat.html

Kratzig, G.P. & Arbuthnott, K.D. 2006. "Perceptual learning style and learning proficiency: a test of the hypothesis." In *Journal of Education Psychology*, 98, 1, 128-246. Retrieved April 20, 2007 from Ebscohost Data base.

Nisaken, J. 2001. "McCarrty's 4Mat curriculum development model." Retrieved May 10, 2007, from http://www.geocities.com/jeniskanen/4mat.htm

Price, L. 2004. "Individual Differences in learning: cognitive control, cognitive style, and learning style." In *Education Psychology*, 2004, 24, 5, 681-697. Retrieved April 20, 2007 form Ebscohost Data base.

Reed, P.A. 2000. "The relationship between learning style and conventional and modular laboratory preferences among technology education teachers in Virginia." Dissertation. The Faculty of the Virginia Polytechnic Institute and State University. Retrieved May 10, 2007, from http://www.scholar.lib.vt.edu/heses/available/etd-32498-15542/unristricted/Chapter3.pdf.

Robotham, D. 1999. "The application of learning style theory in higher education teaching." In *Geography Discipline Network (GDN)*. Retrieved May 10, 2007, from http://www2.glos.ac.uk/GDN/discuss/kolb2.htm

Rossum, E.J. & Hamer, R. (n.d). "Using a model of linked teaching and learning conceptions for curriculum design at the Hotelschool The Hague." Retrieved May 10, 2007, from http://www.hlst.heacademy.ac.uk/resources/link9/link9_6.html

Smith, E.S. 1999. "Intuition-analysis cognitive style and learning preferences of business and management students a UK explanatory study." In *Journal of Managerial Psychology*, 14, 1, 26-38. Retrieved May 20, 2007, from http://www.emeraldinsight.com/insight/ViewContentServlet/Filename/Published/EmeraldFullTextArticle/pdf/0500140102.pdf

Trigwell, K., Prosser, M., & Waterhouse, F. 1999. "Relation between teachers' approaches to teaching and students' approaches to learning." In *Higher Education*, 37, 57-70. Retrieved April 20, 2007, from Ebscohost Data base.

Williamson, M.F. & Watson, R.L. 2006. "Learning styles research: understanding how teaching should be impacted by the way learners learn part II: understanding how learners prefer to receive information." In *Christian Education Journal*, 3,2, n.p. Retrieved May 1, 2007, from Thomson Gale Data base.

Williamson, M.F. & Watson, R.L. 2007. "Learning style research: understanding how teaching should be impacted by the way learners learn part III: understanding how learners' personality styles impact learning." In *Christian Education Journal*, 3,4, 62-76. Retrieved May 1, 2007, from Thomson Gale Data base.

Woolhouse, M. & Blaire, T. 2003. "Learning styles and retention and achievement on a two-year a-level programme in a further education collage." In *Journal of Further and Higher Education*, 27, 2, 258-269. Retrieved April 20, 2007 from Ebscohost Data base.

Zhang, L. 2002. "Thinking styles and cognitive development." In *The journal of Genetic Psychology*, 163, 2, 179-195. Retrieved April 20, 2007 from Ebscohost Data base.