Measuring Students' Thinking Styles to Improve the Teaching and Learning Process

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ABSTRACT

The study was carried out to introduce the use of techniques and models that can be used to measure students' thinking styles and preferences. This paper discusses the benefits that can be driven from the results of the measurements to improve students' learning process as well as improving lecturers' abilities to deliver knowledge and skills that can meet the students' thinking preferences. This paper also discusses the use of Felder-Silverman Learning Style Model and Thinking Style Questionnaires® that have been widely used in the field of education to measure the thinking preferences. From this study, it is hoped that the teaching and learning environment can be improved and become more effective.

Keywords: *Felder-Silverman Learning Style Model, measurement, teaching and learning process, thinking styles and preferences*

Introduction

The challenge for Universiti Teknologi MARA (UiTM) today is to produce graduates that fulfill the twenty one models of graduates that have been outlined in its strategic management. This is because today's knowledge-driven economy emphasises that quality people is critical to the success of business.

The main objective in measuring the thinking preferences of students is to find the right approach that can be best applied in delivering our knowledge and transferring our skills to the students. This will help them in gaining suitable employments as well as encouraging them to take responsibilities for their personal developments in becoming confident, intellectual, independent and global individuals. Furthermore, this will also help to intensify the students' awareness of their roles in the learning process. Therefore, the realisation that everyone thinks differently is the first step in achieving effective collaboration and improving the teaching and learning process.

Thinking and Learning Styles - An Overview

Thinking styles can be described as preferred ways of processing information (Beddoes, 2001). It is also defined as the way information is processed by individuals (Beddoes, 2001). Berry (2005), in his paper on enhancing student learning process, claimed that to be effective teachers, we must understand our students and to be effective students, they must also understand their teachers. Therefore, understanding between these two main parties will lead to learning, which then leads to knowledge and finally leads to success.

Furthermore, Sternberg (1997) added that learning styles can also be described as a preferential mode, through which a person likes to master learning, solve problems, thinks or simply reacts in a pedagogy situation. While, Keefe (1979) described it as the characteristic cognitive, affective and psychological behaviours that serve as relatively stable indicators of how learners perceive, interact with and respond to the learning environment.

All of the definitions mentioned above show that people have different preferred modes of thinking and learning. Those thinking preferences influence how we process and store information, retrieve information and most importantly make meaning out of the information. Therefore, all learning groups are made up of people with different thinking styles preferences, different ways of knowing and different learning styles.

Learning and Thinking Styles Models

There are several learning style models that can be used in measuring the students' thinking preferences. One of the most popular learning style models in use in the field of education is Kolb's Learning Style Model which classifies learners into four classification schemes which are 1) Type 1 for concrete and reflective learners; 2) Type 2 for abstract and active learners, 3) Type 3 for classifying the abstract and active learners, and 4) Type 4 for the concrete and active learners. This model classifies students as having a preference for either a concrete experience or abstract conceptualisation by determining on how they take information in or an active experimentation or reflective observation (Kolb, Rubin, & Osland, 1995).

In addition, the Multiple Intelligences Theory introduced by Gardner (1983) emphasizes seven different potential pathways to learning which are the linguistic, logical, spatial, kinesthetic, sound and music, interpersonal and also intrapersonal intelligence. From this theory, academicians can classify students in terms of their thinking preferences

and will be more prepared in delivering knowledge in right approach. The implication of this theory may result in the varieties of teaching styles that can be best applied in students' learning process (Keefe, 1979).

Another learning style model is the Hermann Brain Dominance Theory (HBDT). This theory classifies students in terms of their relative preferences for thinking in four different quadrants that are based on task-specialised functioning of the physical brain (Hermann, 1996). The quadrants are left cerebral (upper left), left limbic (lower left), right limbic (lower right) and right cerebral (upper right). Each area of the brain has functions associated it to create a model of thinking and learning.

How measuring thinking preferences can improve the teaching and learning process

From the discipline of Neuro Linguistic Programming (NLP), our thinking preferences can be categorised into twenty-six dimensions of cognitive styles which can be split up into three main areas (Beddoes, 2002). Therefore, it is crucial for us to find the best approach that can be applied in delivering knowledge and transferring skills. We have to realise that individuals have preferences which help to account for their personal learning styles. Individuals learn according to whether a learning experience is geared towards their particular style of learning rather than whether or not they happen to be 'clever' in an academic sense.

By measuring the thinking preferences, students will be able to become more effective and receptive learners if they understand what their own personal learning styles are. Besides, lecturers are able to become more effective and receptive instructors if they understand what their students' personal thinking styles are. For instance, in programming field, the transfer of concepts and skills across novices who in this case are the students, and experts who are the lecturers, depends on the detection of potential similarities between them. Novices will be more limited in their abilities for recognising problem similarity where they tend to classify tasks according to surface characteristics whereas experts focus on underlying conceptual properties or casual structures (Karina, 2005). Furthermore, the differences between learning styles and course or content presentation style in programming will affect significantly on students' performances (The Cognitive Fitness Consultancy Ltd, 2005).

The Felder-Silverman Learning Style Model

This well-known learning style model classifies students in ten different areas such as students as sensing or intuitive learners, students as visual

active or reflective learners, and finally students as sequential or global learners. These categories of learners are then grouped into their own dimension of preferences. Sensory learners prefer concrete, practical, facts and procedures. Whereas, the intuitive learners prefer conceptual, innovative, theories and meanings. These categories of learners are grouped under the perception preferences. In the sensory input preferences,_there are visual learners who prefer pictures, diagrams or flow-charts while verbal learners prefer written or spoken explanations (The Cognitive Fitness Consultancy Ltd, 2005).

In the organisational preferences, the inductive learners prefer explanations that move from specific to general. While, the deductive learners prefer explanations that move from general to specific. In the category of processing preferences, there are active learners who prefer to learn by trying things out and like working with others. Whereas, the reflective learners learn by thinking things through and prefer to work on their own. Finally, under the understanding preferences, there are sequential learners who prefer to learn in incremental, orderly steps while the global learners prefer holistic approach and like to learn in large leaps (The Cognitive Fitness Consultancy Ltd, 2005).

The Thinking Style Questionnaires®

This model is called the Thinking Style®. It is a meta-cognitive instrument which measures cognitive and linguistic preferences as well as the flexibility of thinking of individuals or group of students. The areas are:

1)sensory focus which measures how people prefer to receive information via senses such as sight, hearing and touch. This focus consists of visual thinking where students might prefer the use of pictures, diagrams and visual imagery. Auditory thinking focuses more on language and use of words, listening and talking. Kinesthetic thinking involves feelings, emotions, intuition and physical movements. Digital thinking focuses on facts, the use of data and statistics and the degree of data rationality (Sternberg, 1997);

2) people focus which measures how people interact with each other. It involves eight areas of preferences which are the internal and external thinking that relies whether on our own judgments or relies on feedback from others. Self referenced thinking puts our own needs first while the altruistic/others thinking response to the needs of others. Conforming/ matching thinking wants to fit in and dislike confrontation while challenging/mismatching thinking dislikes being told what to do, will challenge and confront. Collaborative thinking involves others, shares

information and always prefer a team environment while competitive thinking always wants to win, enjoy competition with others and strives to better own performance (Sternberg, 1997);

3) task focus measures how people approach to tasks and problem solving. It consists of details conscious thinking where individuals needs the detail and attends to detailed information and produces detailed work. Strategic/big chunk thinking focuses on general principles and summary of information. Creative/right brain thinking involves multi-tasking and enjoys creativity while logical/left brain thinking is more systematic, sequential, ordered and structured. Options thinking explore opportunities, possibilities and alternatives. Procedural thinking believes that procedures are important and always follow instructions. Towards thinking focus on goals and targets and has positive attitude. Troubleshooting/moving away thinking focuses on problems or potential problems and makes contingencies. Proactive thinking initiates action and makes decisions. Reactive thinking analyses and plans, reviews information and considers consequences. Simplicity thinking will simplify complex issues, and has perception of simplicity. Complexity thinking enjoys the challenge of difficulty and complex issues. Sameness thinking seeks stability and prefers the familiar, notices similarities. Finally, differences thinking seek variety, notices what is different and has a high capacity and tolerance for change (Sternberg, 1997)

Discussion

By using this learning style model in the field of computer science, we can understand that, for procedural programming, where real-world objects cannot be directly translated into program constructs, will favour more to the intuitive learners (The Cognitive Fitness Consultancy Ltd, 2005). Whereas, for object-oriented programming, where objects are simulated view of real world objects, favours the sensing learners (The Cognitive Fitness Consultancy Ltd, 2005).The Program analysis courses thought in Universiti Teknologi MARA (UiTM) such as Fundamentals of Computer Problem-Solving (CSC125) will help to develop students' ability to think in conceptual abstractions even if they prefer to learn through concrete facts and procedures. Therefore, lecturers can find ways to connect abstract concept with concrete problems in analysis by organising cooperative learning, integrate algorithm visualization in lecture notes and lab sessions and evaluate learning outcomes when the visualization techniques are applied.

According to Felder (1998), visualizations alone are more helpful to visual learners than non-visual learners. Learning will increase as level of interaction with the visualization system increased. Therefore, lecturers can develop a substantial amount of materials such as the used of images, algorithm visualization, or computer models to accompany their visualizations.

A study done at the Computer Science and System Department, at Wentworth Institute of Technology shows that, there are balances between active and reflective learners (The Cognitive Fitness Consultancy Ltd, 2005). Active learners prefers working in pairs, develop applications through repeated cycles of planning, implementation and testing whereas, the reflective learners prefer working individually, design and model a complete solution on paper before they implement it on the computer. Therefore, in analysis courses, students who prefer active learning may believe that they are weak in theoretical computer science.

The software development field is not strictly bound to the sequential process. Therefore, both sequential and global learners can excel in this field. In contrast, analytic problem solving starts with the problem description and progress one step at a time toward a solution. Therefore, computer science students who are global thinkers may have trouble with the sequential constraint of analysis. For example, Halstead (2006) found that most of the first year engineering students prefer the external thinking preference for the people focus. This means that the students rely more onto the feedbacks from other people around them and require a proper guidance from their lecturers. However, as the students moved into their next semester, they will become more matured and independent learners and this dimension will be less significant.

Besides that, for sensory focus, the visual dimension scored the highest rate which means that the students prefer the information to be expressed in the form of images, diagrams or pictures (Halstead, 2006) This supports the widely use of practical examples, diagrams or computer modeling for the teaching and effective learning. As for the task focus, the moving towards dimension was the highest score which means that the students were moving towards the targets and achievements of their goals (Halstead, 2006). Furthermore, they also have projected positive attitudes towards their lecturers and the course.

This method can be incorporated into several of courses taught in UiTM. For instance, in UiTM Pahang, the percentage of first year students who failed in programming courses is quite high. The lack of understanding and skills in programming are the main causes for the high failure rates. Therefore, it is crucial for the lecturers to find the right approach in delivering lectures in order to meet the students' preferences.

The effective collaboration between the lecturers and students will certainly contribute to the improvement of teaching and learning process. For instance, if we find that the highest score of the thinking preferences for computer science students in the people focus dimension is the collaborative thinking, this means that the students prefer a team environment and willing to share information with others. In addition, if the students score the highest rate of digital thinking for the sensory focus, this means that they much prefer the use of data, facts and figures.

By understanding the students' thinking preferences, the lecturers will be more aware of how important positive and constructive feedbacks are to students. The lecturers must also know and understand that the first semester students need the reassurance of stability and slow steady change. All of this awareness will certainly help the lecturers to deliver their knowledge and transfer their skills in more effective manners.

Conclusion

The results of measuring thinking preferences of students can be used to help the students and lecturers to better understand their behaviours and how they are related and work with each other. This method is useful in the education field to support the development of interpersonal, team building and communication skills among the students as well as the lecturers. This is because the trends in thinking preferences shown by students will cause lecturers to reflect on their own thinking styles and certainly will improve the teaching and learning process in the universities.

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