Disciplinary differences in personal attributes:  
A review of the literature

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Abstract: - This paper is a review of research studies on disciplinary differences in specifically individual attributes: thinking and learning styles, motivational goal orientations, and epistemological beliefs. The paper begins with individual differences in learning, what is the thinking style (in term of procedural thinking), what is the learning style, the motivational goal orientation, the epistemological belief, how these factors are important, and disciplinary differences. Moreover, we point to the importance of personal attributes enhancing the students’ learning performance and varying across disciplinary areas.

Key-Words: - disciplinary differences, learning styles, thinking styles, procedural thinking, way of knowing, motivational goal orientations, epistemological beliefs, individual differences, personal attributes

1 Introduction

In recent years, many researchers are interested in studying of how to answer these questions “Why do some people learn better than others? Are there any difference in students’ learning across different disciplinary areas?” Previous research has indicated there are many different aspects of people which result from many factors such as gender, social context, heredity, religion, beliefs, family, and others. These factors have an influence on the ability of learning. Prior research has studied about the difference in the personal attributes. They have found that there are individual differences in personal thinking styles, learning styles, motivational goal orientations, and epistemological beliefs. The thinking style which is in this paper called ways of knowing can be divided in two types which are connected and separated. There are many aspects of learning styles, in this article we emphasize on visual and verbal learning styles. The motivational goal orientations which are also important in students’ learning abilities can be viewed as the mastery and performance goal orientations. The last factor we concern in this paper is the epistemological belief which is one of branch in philosophy. Epistemological beliefs are the beliefs in nature of learning and knowing and classified into the certain knowledge, the simple knowledge, sources of knowledge, quick learning and the innate ability. These factors can be able to shape students’ learning abilities and achievement. Moreover, the research in the disciplinary difference areas has shown that personal attributes mentioned above vary across disciplinary areas. Definitely, we can assume that not only have the individual differences but the disciplinary differences also influenced on personal attributes.

This paper is organized into seven sections which deal in turn with the individual differences in learning, what is the thinking style, what is the learning style, the motivational goal orientations, the epistemological beliefs, how these factors are important, and disciplinary differences. The conclusion of this paper looks at the importance of these factors toward both students and teachers in learning environment.

2 Individual Differences in Learning

“No two persons are born exactly alike; but each differs from the other in natural endowments, one being suited for one occupation and the other for another.” Plato who was the Greek philosopher stated that sentence more than 2000 years ago. People who are around us in the society are different. Some people are optimistic; some people are pessimistic; some people like black color; some people like white color. An individual difference is a cornerstone subject area in modern psychology [1]. The psychologist began to consider individual
differences in the end of the nineteenth century. Charles Darwin (1859) suggested the theory of evolution which emphasized the importance of individual differences. He argued that nature selects successful traits through the survival of the fittest. Sir Francis Galton (1822-1911) concluded that individual differences were of as much relevance to the species of human as to other species [1]. The study of individual differences is still being the modern psychology and concerning with differences between people. The goals of the researchers in the area of individual differences are concerned with illustrating how/why people are different from others [2].

People are different not only in general behaviors but in learning also. Clearly, some people have the ability in cognition, perception, or understanding more than others in the same learning task. From that different ability, many educators often wonder why some students are different in learning abilities [3] and they also want to understand the individual differences in learning which is an important issue in education psychology [4]. They believed that individual differences in abilities result to student’s successes and failures [5]. Therefore, awareness of individual differences in learning will advantage both learners and teachers, especially the teachers are able to suitably provide the learning environment.

According to many researches, individual differences in learning have an influence upon many factors for example, learning styles [6], thinking styles [7], personality traits [8], culture [9], epistemological beliefs [10], achievement goal orientations [8], and so on. Students and teachers should know and understand these factors which are very important for learning environment setting because they can shape students’ learning performance. From all of factors, learning styles, thinking styles, achievement goal orientations and epistemological beliefs are the main point of view in this review.

3 Thinking styles

3.1 What is thinking style?

For the thinking styles, there are many explanations of thinking styles. For example, Carmel Streater, MS, DREI [11] suggested that the person’s thinking style is the way in which his or her brain processes facts. Robert J. Sternberg and Li-fang Zhang [5] explains that thinking style is a preferred way of thinking or doing things. Robert J. Sternberg [12] explains that “Thinking style is how we prefer to use the abilities we have”. Therefore, the concluded meaning of “thinking style” is the preferred way in which an individual processing information or their preferred approach to use such information to solve problems.

3.2 Type of thinking styles

3.2.1 Sternberg’s theory of mental self-government

In the 1950s and early 1960s, the researchers were interested in cognitive styles (or thinking styles). The different theories of thinking styles have been constructed. There were many theories which were proposed by several psychologists. Sternberg [5] proposed a more general theory of thinking styles. This theory was called the theory of mental self-government which addresses people's thinking styles. The main point of this theory is the notion these people need somehow to govern or manage their everyday activities. They will select the way or choose styles of managing themselves that they feel comfortable for doing. The style can be changed by the situation and may have a different preference in another situation and people. The theory of mental self-government posits 13 thinking styles that fall along five dimensions of mental self-government: (1) functions (including the legislative, executive, and judicial styles), (2) forms (hierarchical, monarchic, oligarchic, and anarchic styles), (3) levels (global and local styles), (4) scopes (internal and external styles), and (5) leanings (liberal and conservative styles) [12].

Zhang & Sternberg [5] reconsidered these types of thinking styles into three types: (a) the legislative (being creative), judicial (evaluative of other people or products), hierarchical (prioritizing one’s tasks), global (focusing on the holistic picture), and liberal (taking a new approach to tasks) styles (b) the executive (implementing tasks with given orders), local (focusing on details), monarchic (working on one task at a time), and conservative (using traditional approaches to tasks) styles and (c) The anarchic (working on whatever tasks that come along), oligarchic (working on multiple tasks with no priority), internal (working on one’s own), and external (working with others) styles. On the other hand of thinking styles, Koul [13] stated “Belenky et al., (1986) have recognized and described two modes of procedural thinking that they call separate ways of knowing and connected ways of knowing” (p. 309).

3.2.2 Ways of Knowing

In the late 1970’s, Belenky [14] explored the personal and educational experiences of women by in-depth interviews of 135 women. They studied their stimulating and informative account of women’s ways of knowing and the development of the female voice, self, and mind. They suggested that women have five different epistemological positions and reclassified into either
passive acceptance of knowledge or active construction of knowledge, described by Clinchy (2002), Galotti, Clinchy, Ainsworth, Lavin & Mansfield (1999). The first three passive positions (i.e., silence, received knowing, subjectivism) were classified as preprocedural knowing. The last two active constructive positions of ways of knowing (separate knowing and connected knowing) were classified as procedural knowing [15].

Separate knowing (SK) stresses the evaluating knowledge in an objective, formal logical argumentation without including the feelings and emotions. In contrast, connected knowing (CK) stresses the empathy of personal connection and understanding the socially connected nature of knowledge. For example, separate knower likes to remain as objective as possible to construct knowledge from a critical objective perspective. When the separate knowers are put another ideas that differ from their own ideas, they like to analyze a situation first, and then try to understand another person’s perspective [16]. They defend their own ideas unless proven facts from reputable sources. Connected knower is more sensitive to other people and when constructing knowledge they open to the voice of intuition or interpersonal experiences and attempt to learn by sharing the experience with other people which led to the knowledge.

4 Learning styles

4.1 What is learning style?

There are many definitions of learning style concepts from researchers or educational psychologists. For example, Dunn & Dunn (1993) explained that learning style is the way which each student uses to process, absorb, and retain new knowledge. Keefe (1979) stated that learning style is controlled by three factors: cognitive, affective, and psychological factors that affect how students perceive interact and response to learning environments. Even though the previously mentioned definitions are explained, the common expression of the learning style refers to way of learning or an innate pattern of thinking, perceiving, or processing the learning task. The style of learning is applied by the learners as learning in the different ways. The learning style of each learner may be different depending on educational situations or problems.

Some of the most popular learning style schemes include (1) the model of Dunn & Dunn who are the first person using the learning style concepts, (2) the learning style Inventory by Kolb (1985) who had been developed researches on “Experiential Learning Theory” (as cited in [17]), and (3) Honey and Mumford’s (1992) Learning Styles Questionnaire [18].

4.2 Type of learning styles

In recent year, learning styles are classified in many different ways [19]. David Kolb (1985) proposed the theory of experimental learning model based on these four preferences: active experimentation, concrete experience, abstract conceptualization, and reflective observation. According to Kolb, the four learning modes can be combined to create four learning styles: (1) Divergent, (2) Assimilation, (3) Convergent, and (4) Accommodation. Richard Felder and Linda Silverman’s study (1988) which is revised by Felder in 2002 contributed learning styles into four dimensions based on personality of learners which are active-reflective, sensing-intuitive, visual-verbal, and sequential-global. Chafee (1999) classified learning styles into three aspects followed by the way in which the learner best perceives and remembers knowledge: visual, auditory, and kinesthetic. Tony Grasha and Sheryl Hruska-Reichmann (2006) developed the learning style model to identify and categorize the learners’ learning behavior preferences and learning environment as avoidant, dependent, participant, independent, competitive, and collaborative styles. Until today, there is a lot of learning style models which we do not review in this paper. Some of them are Honey and Mumford learning style model, Fleming's VARK learning style model, Albert Canfield learning style model, Silver-Hansen-Strong learning styles model, McCarthy learning style model and so forth.

5 Motivational goal orientations

In the literature, students have two types of major goal orientations: learning goal (on the other hand called mastery goal) orientation and performance goal orientation [20]. Students with mastery goal orientations are interested in and focus on developing new skills, learning according to self referenced standards and seeking challenged tasks [21]. In contrast, students with performance goal orientations focus on overachieving and goals which allow to be outperforming all others in their classroom [13].

6 Epistemological beliefs

Previous research in the epistemological belief areas, one of the branches in philosophy, has grown over the past 30 years [10,22]. A starting point of epistemological beliefs come from Perry (1970) work [23].

Schommer (1990) stated that epistemological beliefs are beliefs held by students about the nature of knowledge and learning. Accordingly, Schommer proposed five dimensions of epistemological beliefs: (1) certain knowledge (knowledge is certain rather than
tentative), (2) simple knowledge (knowledge is simple rather than complex), (3) knowledge source (knowledge is handed down by authority rather than derived by reason), (4) quick learning (learning is quick or not at all), and (5) innate ability (the ability to learn is fixed at birth rather than improvable). The questionnaires developed by Schommer comprised 12 subsets of items followed by the dimensions mentioned above.

There are two types of students in terms of beliefs; simple and sophisticated epistemological beliefs. Students who adopt the first one have faith in knowledge as absolute, unchanging, predominantly black and white, handed down by authority, acquired quickly or not at all, and ability to learn is fixed at birth. In contrast, the latter relies on multiple sources, integrating knowledge from other opinions and viewing knowledge as something which is complex and tentative [24].

7 How these factors are important in learning?

Knowing and understanding in thinking styles, learning styles, motivational goal orientations, and epistemological beliefs, the major of types of individual differences in learning, are important for learning development system. The students can enhance the learning ability when they know and understand their personal attributes. Teachers can also provide the suitable learning environment and choose the most suitable strategies for teaching. Prior research has studied the importance of these factors toward learning performance as following:

The study on procedural thinking (separate and connected knowing) conducted by Schommer-Aikins and Easter (2006) has found that the separate and connected knowing has an effect on academic performance in terms of learning speed. Due to the understanding of students’ thinking styles, teachers can properly provide the learning environment. Students can also know their own learning preferences, for example debate or discussion approaches can enhance students who are separate. On the other hands, cooperative and collaborative approaches can enhance students who are connected.

The study of the effects of cognitive learning styles on 1st-year academic performance in 19 university courses conducted by Drysdale [25] has shown that the academic performance is based on learning styles. Consistently with Bahars’ study which examined the relationships between pupils’ learning styles and their performance in mini science projects.

Moreover many empirical studies show that epistemological beliefs have an influence upon students’ learning (e.g. reading comprehension, persistence and quick reading) (Schommer, 1994, as cited in [26]) and selecting strategies in study. The epistemological belief is also related with the variety of learning outcomes including students’ academic performance [27,28]. Tolhurst (2007) stated that it is interesting to develop curriculum or learning environment to encourage students’ beliefs from simple to sophisticated epistemological beliefs [29].

8 Disciplinary differences

Knowledge is the essential fundamental of human and society. Nobody, however, can know everything in every area. Actually, there are many disciplinary areas of knowledge and learning. In the overview, science and arts are the main areas of the educational system on high schools until university levels and they are divided in several major areas such as science, engineering, nursing, liberal arts, and etc. There are many factors (e.g. knowledge content [30], nature of instruction and task [31], or nature of the profession) used to classify the disciplinary in several areas. Biglan model (1973) is one of the most models that are used in many researches. He used multidimensional scaling to classify faculty responses from data collection on 36 areas of the University of Illinois and 30 areas at a small western college. From his study he suggested three dimensions: 1) existence of a paradigm, 2) concern with application, and 3) concern with life systems. The first dimension is based on the level of paradigm development (hard-soft). The major of physical and biological sciences, engineering, and agricultural are considered to be paradigmatic (hard disciplines). Contrastingly the major of humanities, business, social sciences, and education areas are not paradigmatic (soft disciplines). The second dimension is based on the concern with the practical application (pure-applied). The major of physical sciences, humanities, and social sciences represent the pure disciplines. The majors of engineering, business, agricultural, and education are concerned with the practical applications. The third dimension is concerned with the life systems such as living and organic objects (life-nonlife). Majors with concern in life consist of the social and biological sciences, and education. Majors with not related life are physical sciences, engineering, humanities, agricultural, and business [32].

There are many researches which conducted the result of disciplinary differences, for example Vanderstoep et al. (1996) suggested that components of knowledge, motivation, and self-regulation vary across the disciplinary differences. The research conducted by Pike and Killian (2001) has also found the differences in the college experiences and learning outcomes of students in pure and applied disciplines. Based on disciplinary differences, researchers investigated the
result of differences in many aspects of educational system, for instance, teaching approaches, teaching styles including personal attributes of students. In a large survey of M.I.T. seniors, Kolb & Goldman (1973) has been found a correspondence between learning styles and departmental major. Likewise, A. Slaats [33] stated that “Vermunt found discipline to be an important predictor of learning styles” (p. 479); which is corresponding with the result of the previous study. They have found that students’ learning styles vary across the disciplinary areas in a vocational study.

Moreover, Breen and Lindsay (2002) have found that students in different disciplines require different motivations. Some types of motivations can make students successful in some disciplines, in contrast failure in others. In areas of epistemological beliefs, Paulsen and Wells’s 1998 study;

“Students majoring in pure fields were less likely than those in applied fields to hold native beliefs in simple knowledge, quick learning, and certain knowledge, and students majoring in soft or pure fields were less likely than others to hold native beliefs in certain knowledge.” (p. 365)

9 Conclusion
In study processes, Biggs (1979) stated that input, process, and output were three stages in student learning. Input stages are concerned with contents, material, and others. Process stages are the ways selected by student preferences (which have many factors that influence upon selecting such as personal attributes, disciplinary areas, or social context). The knowledge and learning achievement are output stages. For all of three stages, the process stage is the interesting part in this paper. This paper has sought to provide a review of individual differences in learning in scope of personal attributes particularly thinking styles, learning styles, motivational goal orientations, and epistemological beliefs. This article also mentioned about the influence of disciplinary differences toward the personal attributes and described two main issues. Firstly, many researches show evidences that the personal attributes have influences for students’ learning performances. Second, some studies suggest that disciplinary differences correlate with learning styles, motivation, and epistemological beliefs including predicting a learning performance (Byrnes, 1995, as cited in [33]). For more extension, students in different disciplinary areas might be different in personal attributes.

In the present, there is a greater need for research to investigate the difference of the individual attributes across disciplinary areas. In particular, an empirical research on thinking styles, learning styles, motivational goal orientations, and epistemological beliefs can help both students and teachers to appropriately design the learning environment and enhance the students’ learning performance.

References:
SELECTED TOPICS in EDUCATION and EDUCATIONAL TECHNOLOGY


