The Influence of Learning Styles and Perceived Instructional Styles on Academic Performance of University Students in Thailand

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Abstract: *The present study investigated the influences of learning styles and perceived instructors' teaching styles on the academic performance of students at a private university, Thailand. Specifically, the study investigated whether the 'fit' between the students' learning styles and their perceived instructors' teaching styles contributed positively to their academic performance. The four different learning preference styles employed in this research were external learning, internal learning, interactive learning, and procedural learning and the five perceived teaching styles were expert, formal authority, personal model, facilitator, and delegator. Path analysis via structural equation modeling indicated that regardless of how the students evaluated their instructors' teaching styles, employment an external style of learning was associated with their higher academic achievement.*

Keywords: *Learning styles, Teaching styles, External Learning, Internal Learning, Interactive learning, Procedural Learning*

1. Introduction

The world-wide educational system has been experiencing rapid changes as a result of technological advances and globalization. Research interest in exploring individual differences in learning was noted as far back as the 1900's, and since then, different terminologies and criteria for determining specific approaches to both instruction and learning have been published. Learning styles can be interpreted as students' approaches to learning, problem solving, and processing information (Snow, Corno, & Jackson, 1996). The challenge faced by the present-day educational system is the difficulty in implementing teaching interventions that match students' traits (Griggs, 1991;Yang &Lynch, 2014). Exploring learning styles provides significant information of how people perceive, make interactions, and reciprocate to the situations in which learning happens (Griggs, 1991).

Instructors generally have a tendency to develop an instruction style which is commensurate with their own learning style. However, if students' learning styles do not match with the instructors' teaching styles, then students often become bored with the course materials and both their performance in and their attitude toward their courses and/or their study programs may decline (Felder & Silverman, 1988). That is, the cause of decline may not be because of the poor quality of instruction but because of the mismatch between instruction and learning styles. It can be inferred from the extensive research carried out by Dunn, Beaudry and Klavas (1989) that those students who had scored poor and average in their academics were taught with the instructional styles that matched their learning styles and it was interesting to note that they performed much higher on standardized achievement and attitude tests. The aim of the present study is to investigate the influences of

university students' learning styles and their perceived instructors' teaching styles on their academic performance.

Learning Styles

Dunn and Dunn (1992) defined learning as the accruing of knowledge, expertise, and skills by a person through experience or education. The capacity to learn at a deeper intellectual level differentiates human beings from all other animals or species. The extent of that learning is marked by significant changes in behaviors (Gredler, 1997; Lefrancois, 2000). People learn in different ways and the ways by which people accrue knowledge can be termed as learning styles (Hein, 1991).

Learning styles have been defined as the way one perceives and thinks and the preference of each individual on the way he/ she learns. (Pervaze, Shahida, 2008; Dunn & Dunn, 1992; Pritchard, 2005). According to Keefe (1979), learning styles are the amalgamation of "cognitive, affective, and physiological traits that are relatively stable indicators of how learners perceive, interact with, and respond to the learning environment" (pg. 1). Thus, a specific learning style is an individual's preferred method to think, to process information and to demonstrate learning (Pritchard, 2005). Learning style can be interpreted as the way a child memorizes new and complex information by hearing, seeing, reading, writing, illustrating or verbally saying it out (Dunn & Dunn, 1992). Each person perceives and process information in different ways.

Research on learning and instructional strategies has furnished teachers and students with diverse views of instruction and learning within the classroom. Shroeder (1993) noted that the "typical" university students' learning style profile is continuously undergoing modifications and that there is a much greater discrepancy in the span of learning styles preferences to be examined in the field of education today. Therefore, it would be useful for instructors to identify what learning style preferences are employed by their students and to design their teaching strategies to match their students' learning styles (Agogino & His, 1995; Birkey & Rodman 1995; Dewar, 1995; Hartman, 1995; Kramer-Koehler, Tooney & Beke, 1995).

Felder and Soloman (1993) categorized individuals into different groups according to their learning styles and tried to identify the common characteristics of each group. They identified eight types of learners including (1) *active learners* who store and comprehend information by having hands on experience; they tend to discuss, apply, and explain information to others, and prefer to work in groups, (2) *reflective learners* who like to think about learning material without any distractions and prefer working alone, (3) *sensing learners* who like learning facts, solving problems and performing laboratory work; they are more practical and careful, (4) *inductive learners* who like to explore different opportunities and linkages and associations, (5) *visual learners* who recollect what they see, like pictures, work charts, tables, flow charts, time lines, videos and demos, (6) *verbal lea*rners who gather information from descriptive words that are spoken or written, (7) *sequential learners* who has a pattern of logical steps in deriving at solutions, and (8) *global learners* who put things together and absorb material almost randomly without seeing connections. According to Felder (1996), each student is unique in his/her learning style, like their nature and character. For example, some students have a tendency to concentrate on facts, data and algorithms, whereas others focus on theories and mathematical models. More recently, Felder (2002) classified different learning styles on an 'inductive-deductive' dimension and on a 'visual-verbal' dimension: (1) Inductive learning is problem-based learning, (2) deductive learning is learning with fundamentals and proceeding to applications, (3) visual learning includes pictures, diagrams, charts, plots, and animations, and (4) verbal learning includes spoken words and other sound.

Ned Herrmann's Whole Brain Model

Herrmann (1996) explained that heredity is not the sole cause for our mental preferences. Our preferences result from both nature (genetic inheritance) and nurture (parenting, teaching, life experiences and cultural influences). His Four Quadrant Whole Brain Model is a combination of Roger Sperry's left/right brain theory (1981) and Paul MacLean's triune model (1990) (rational brain, intermediate brain, and primitive brain). This explains the four modes that an individual's relative preference for thinking is based on the task specialized functioning of the physical brain (Herrmann 1995). Similar to other brain models, each area of the Whole Brain Model has functions associated with thinking and learning. Practitioners of the Whole Brain Model label each quadrant according to the persons whose strongest preference is in that quadrant (Leonard, 2000; She, 2005). The quadrants are:

1. *Quadrant A (Left Cerebral; upper left)* and is represented by those labeled as theorists. These are people who prefer lectures, facts, and details they critically analyze and depend on information from books. They are logical, analytical and factual. Students identified in this quadrant are logical, methodical, diagnostic, fact-based and critical. They are called *external learners*.
2. *Quadrant B (Left Limbic; lower left)* and is represented by those labeled as organizers. Organizers prefer to learn by making outlines, preparing checklist, doing exercises, practicing worksheets, and using step-by-step problem-solving; they prefer to follow instructions and procedures. Students identified in this quadrant are sequential, systematic, orderly, elaborate and meticulous. They are called *procedural learners*.
3. *Quadrant C (Right Limbic; (lower right)* and is represented by those labeled as humanitarians. Humanitarians prefer group discussion, cooperative learning, doing role-play to enhance understanding, and to dramatize as a means to elaborate. Students identified in this quadrant are sensitive, relational, perceptible, kinesthetic and symbolic.. They are called *Interactive learners*.
4. *Quadrant D (Right Cerebral; upper right)* and is represented by those labeled as innovators. Innovators prefer brainstorming, use analogy, symbols, illustrations and visuals; they also prefer mind mapping and more holistic approaches. Students identified in this quadrant are visual, holistic and innovative.. They are called *Internal learners*.

- This method of classification is based on the task-based functioning of the physical brain and categorizes students on the basis of their preference for thinking along the four different learning modes. The Whole Brain Model of learning thus offers a physiological approach to the way students cognition work, learning and communication happen. The model articulates the basic characteristics of thinking styles based on the four quadrants and renders resources for practical application and research.

Typologies of Instructional styles

There are many instructional design models which are considered ideal are developed for teachings in class rooms. Instructors that apply these models may have their teaching styles characterized based on a combination of models or strategies. *Instructional style* generally refers to the strategies and methods an instructor uses and has been defined as "a set of teaching tactics" (Galton et al., 1980).

Mosston and Ashworth (1986) reported the following list of 10 common instructional styles based on the concepts of *teacher-centered* and *student-centered* teaching styles (Behar-Horenstein, Mitcher, Notzer, Penield and Eli 2006).

- Style A is referred to as *command* where the instructor makes all decisions.
- Style B is referred to as *practice* where students carry out instructor-prescribed tasks.
- Style C is referred to as *reciprocal* where students work togther with another student in which one makes the perfromance and the other provides feedback.
- Style D is referred to as *self-check* where students make an assessment of their own performance against set specifications.
- Style E is referred to as *inclusion* where the instructor does the planning and the student monitors their own work.
- Style F is referred to as *guided discovery* where students solve problems with assistance.
- Style G is referred to as *divergent* where students are able to solve problems without the assistance of the instructor.
- Style H is referred to as *individual* where the instructor determines content and the student plans the program.
- Style I is referred to as *learner initiated* where the student plans their own program and the role of the instructor is to act as an advisor.
- Style J is referred to as *self-teaching* where the students are responsible fully for the process of learning.

Grasha and Reichman (1996) posited four different instructional styles, which are 'formal authority', 'demonstrator' or 'personal model', 'facilitator', and 'delegator'. Instructors who use the *formal authority* instructional style tend to focus on the content of the course. This teaching style is focused on the instructor, where the teacher has sole control of the course content and is responsible for its dissemination . Instructors who use a *demonstrator* or *personal model* teaching style tend to conduct instructor-centered classes that emphasize

demonstration and modeling. These instructors make good role models because of their demonstrating skills and their ability to help students to improve and make use of these skills and knowledge. Instructors who use a *facilitator model* teaching style have a tendency to emphasize student-centered learning and they place more responsibility on the students to take initiations to meet the demands of various learning tasks. Instructors who use the *delegator* instructional style tend to give importance to responsibility of students on learning. This type of instructor generally allows the student to create and carry out their own projects and mentors them or consults them to carry out the completion of the project.

The present study is designed with an objective of investigating if there is a 'fit' between the students' learning styles and their perceived instructors' teaching styles and also if it will contribute positively to their academic performance. Figure 1 presents the study's conceptual framework.
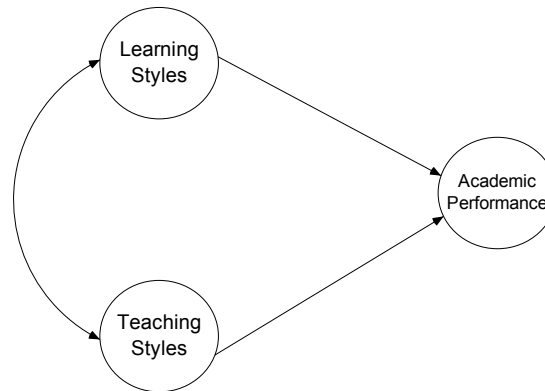

Fig. 1 The influence of learning styles and perceived instructional styles on academic performance

2. Method

Participants and procedure

A total of 1608 undergraduate students (male: N=712, 44.3%; females: N=896, 55.7%) were taken from the population of undergraduate students enrolled in a private University, Thailand. The participants age ranged from under 18 to 27 years and older and with a mean age within the interval 18 to 26 years. The majority of the student participants were enrolled in the School of Management (N=876, 54.1%) and in the School of Arts (N=348, 21.5%). Convenience sampling was employed to obtain the sample. This technique involved approaching students in their classes (with the lecturer's permission) and inviting them to take part in the study. Those who were willing to be part of the research voluntarily filled in the study's questionnaire. .

Materials

Participants answered a questionnaire that comprised four sections. Section 1 comprises of five items to elicit information about the participants' gender, age, Faculty enrolled in, year of study, and nationality.Section 2 consisted of the 60-item Learning Style Questionnaire (LSQ) (Vijayakumar & Varma, 2004) designed to operationalize the four students' learning preference styles (external learning, internal learning, interactive learning, procedural learning). Each item was to be rated on a 5-point Likert scale with high scores indicating strong endorsement of the learning preference styles.Section 3 consisted of the 40-item Grasha-Reichmann Teaching Styles Inventory (Grasha, 1996) designed to tap the five teaching styles of expert, formal authority, personal model, facilitator, and delegator. The inventory was designed as a web-based self-administered tool that allowed college/university instructors to assess their teaching styles. However, as the present study investigated the instructors' teaching styles from the student participants' perspective, the items were modified in their wording to reflect the student participants' assessment of their instructors' teaching styles. Each item was to be rated on a 5-point Likert scale with high scores indicating strong endorsement of the perceived teaching styles. Section 4 consisted of 4 items written to tap the student participants' academic achievement. These four items measured the students' cumulative GPA, the total number of credits earned, the total number of subjects studied, and the number of grades (A, B, C, D, W) received.

3. Results

Confirmatory factor analysis (CFA)

A four-factor model representing the student participants' four learning styles was posited. For this measurement model, the four latent constructs of 'external learning', 'procedural learning', 'interactive learning' and 'internal learning' were represented by 16, 7, 5, and 7 indicator items respectively. Though it is true that more measurement indicators represent latent construct well, in practice it will be quite difficult to have too many indicators to fit a model for the data set (Bentler, 1980). According to Hair et al.'s (1997) three indicators was considered as the minimum number to represent a construct .The researcher followed Hair's proposition and restricted to three indicators for each latent construct of the proposed model. *Item parcels* were used to reduce the measurement items for each latent construct. Item parceling is basically done totaling the responses of each items and then use the total scores in the latent variable analysis Figure 2 is the four-factor measurement model representing the four learning styles (external learning, internal learning, interactive learning, procedural learning). Each of the latent learning style factors were indicated by the by three computed indicator variables (item parcels). All the factor loadings of this model were freed. Each indicator could only correlate to one factor and the four factors were correlated ,which is similar to oblique rotation.
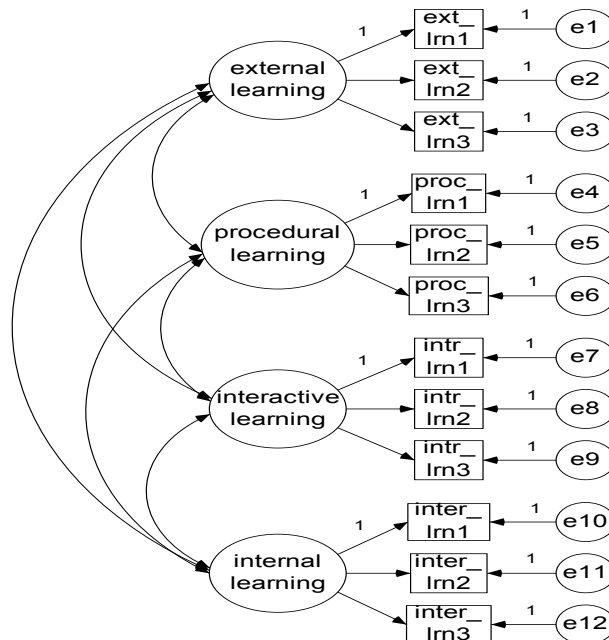

Fig. 2 Confirmatory factor analysis model for learning styles

To tests the overall goodness -of-fit of the posited priori 4 factor learning styles model the study employed confirmatory factor analysis via structural equation modeling (Figure 2). To test the null hypothesis a χ^2 goodness-of-fit test (via the statistical program AMOS 7.0; SPSS, Inc. 2006) was employed. The sample covariance matrix was computed and Table 1 presents this model's goodness-of-fit indices.

TABLE I χ^2 goodness-of-fit value, normed fit index (NFI), incremental fit index (IFI), Tucker-Lewis index (TLI), comparative fit index (CFI), and root mean square error of approximation (RMSEA)

Model	χ^2 (N=808)	df	p	NFI	IFI	TLI	CFI	RMSEA
Null Model	6847.32	78	<.001	0.00	0.00	0.00	0.00	0.23
Four-factor	301.12	48	<.001	0.96	0.96	0.94	0.96	0.05
Model								

The overall chi-square value was significant, χ^2 (df = 48, N = 808) = 301.12, p <.001, the incremental fit indices ((NFI, IFI, TLI, CFI) are all above 0.90 (range: 0.94 – 0.96). From these fit indices it can be presumed

that the model provided a good fit relative to a null or independence model (i.e., the posited model represented over 90% improvement in fit over the null or independence model), and support the hypothesized structure of the posited four-factor learning styles model. The RMSEA value is 0.05 and this also comes within the range (Browne and Cudeck ,1993) and again from this it could be presumed that the model fits the population covariance matrix very well.

Second-order path analysis

As stated earlier, the primary aim of this study was to investigate the 'best match' between perceived instructors' teaching styles and the students' learning preference that would produce the most effective student learning. To this end, this study posited a teaching-learning model that integrates the five teaching styles of expert, formal authority, personal model, facilitator, and delegator and the four learning styles of external, procedural, interactive, and internal learning. This model allowed for a 4 (learning styles) x 5 (teaching styles) factorial combination that yielded 20 'matched' teaching-learning models. Thus, to investigate the 'best match' between perceived teaching styles and students' learning preference that would produce the most effective student learning, path analysis via structural equation modeling was employed to test the efficacy of each of these 20 'matched' teaching-learning models in predicting the students' academic achievement.

For the path analysis, each of the 20 teaching-learning models was treated as a second-order exogenous factor and represented by (1) a first-order learning style factor, and (2) a teaching style measurement variable. The dependent variable of students' academic achievement was operationalized as a latent construct represented by the measurement variables of GPA. Figure 3 presents an example of a 'matched' teaching-learning model (internal learning-expert teaching) posited to predict the students' academic achievement. The model is fully specified.
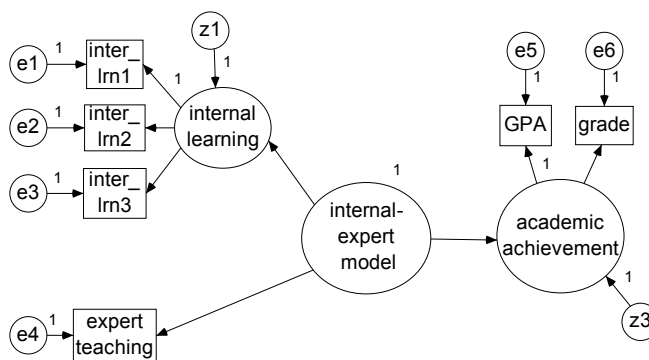

Fig. 3 Internal learning-expert teaching path model predicting academic achievement

Second-order path analysis via structural equation modeling was employed to test each of the 20 'matched' teaching-learning models (see Figure 3). Table 2 presents the standardized regression weights (β) and goodness-of-fit indices for all 20 teaching-learning models.

It can be seen that the teaching-learning models that offered the best fit to the data set as well as producing the greatest number of significant standardized regression coefficients between the teaching-learning models and the students' academic achievement are the ones that included the external style of learning. That is, regardless of the students' evaluation of their instructors' teaching styles, their employment of an external style of learning is associated with their higher academic achievement. This is demonstrated by four of the five 'external learning-associated models' yielding significant and positive relationships with the students' academic achievement ($p<.05$). These findings suggest that for the undergraduate students in the present study, the 'best match' between perceived teaching styles and their learning preference in producing the most effective learning is one which incorporates an external style of learning, regardless of perceived teaching styles.

TABLE II Standardized regression weight (β), χ² goodness-of-fit value, and Akaike information criterion (AIC) for teaching-learning models predicting academic achievement

Model	β	χ² (N=808)	df	p	AIC
External learning					
• Expert	.09**	9.39	9	>.05	45.39
• Facilitator	.08*	9.49	9	>.05	45.49
• Formal authority	.09**	6.14	9	>.05	42.14
• Personal model	.09*	9.12	9	>.05	45.12
• Delegator	.06	23.13	9	<.05	59.13
Procedural learning					
• Expert	.06	34.57	9	<.001	72.57
• Facilitator	.01	30.01	9	<.001	66.01
• Formal authority	.04	35.64	9	<.001	73.64
• Personal model	.02	30.08	9	<.001	66.08
• Delegator	-.06	31.94	9	<.001	67.94
Interactive learning					
• Expert	.05	34.62	9	<.001	70.62
• Facilitator	.02	31.28	9	<.001	67.28
• Formal authority	.05	26.74	9	<.01	62.74
• Personal model	.03	30.10	9	<.001	66.10
• Delegator	-.02	28.13	9	<.001	64.13
Internal learning					
• Expert	-.07	31.84	9	<.001	67.84
• Facilitator	-.09	26.18	9	<.01	62.18
• Formal authority	-.07	31.84	9	<.001	67.84
• Personal model	-.08	14.65	9	>.05	50.65
• Delegator	-.09*	28.23	9	<.01	64.23

* $p<.05$
** $p<.01$

The efficacy of employing an external style of learning in predicting higher academic achievement is further demonstrated by an examination of the goodness-of-fit indices for all 20 teaching-learning models. First, it is evident from Table 3 that of these 20 models, the first four models that incorporate an external style of learning offer the best fit to the data by means of the χ²-goodness-of-fit index. The χ² values for these four external learning models are statistically non-significant which gives an indication that these models best represent the way these four matched teaching-learning models influenced the students' academic achievement. Second, the goodness-of-fit of the 20 models cannot be directly compared as the models have identical degrees of freedom. AIC (Akaike information criterion) measure can be used evaluate their ability to achieve their fir relative to the degrees of freedom (Akaike,1987). AIC takes into account both model parsimony and model fit in evaluating the hypothesized models. Simple models that fit well receive low scores, whereas poorly fitting models get high scores. Comparing the AIC values of the four matched external learning models (external-expert, external-facilitator, external-formal authority, external-personal model) against the AIC values for the other 16 matched teaching-learning models, it is evident (see Table 3) that the four matched external learning models are both more parsimonious (for the loss of 1 degree of freedom) and better fitting than the other 16 matched teaching-learning models.

4. Discussion and Conclusions

The four learning styles identified were external learning, procedural learning, interactive learning and internal learning. Confirmatory factor analysis confirmed the adequacy of this factor structure in representing the four learning styles and provides evidence for the construct validity of the Learning Style Questionnaire (LSQ) (Vijayakumar & Varma, 2004).

The primary aim of this study was to investigate the 'best match' between perceived instructors' teaching styles and the students' learning preference that would produce the most effective student learning outcome. To this end, this study posited 20 teaching-learning models yielded from the 5 x 4 factorial combination of the five teaching styles of *expert, formal authority, personal model, facilitator, delegator* and the four learning styles of

external, procedural, interactive, and internal learning. Results from the path analyses indicated that regardless of the students' evaluation of their instructors' teaching styles, their employment of an external style of learning was associated with their higher academic achievement. This finding of a best match between learning and teaching styles is in line with those obtained from past research which showed that compliance between teaching method and preferred learning styles have positive effects on the students' immediate and deferred achievement, as well as their concept acquisition and retention. For example, in his study which involved the learning of the concept of buoyancy by eighth graders, She (2005) found that external learners performed better than either procedural, internal, or interactive learners.

Any empirical study will have its own limitations, and the results of the present study must be interpreted keeping this in your mind. One limitation can be the design of the study. The correlational nature of the results and the cross-sectional design can be a drawback and can withheld any clear conclusions being drawn about the cause-and-effect of the exogenous and endogenous variables in the learning-teaching style models. In order to validate the causal effects of the presented variables, further research employing panel-study data from a two-or-more wave field study may be necessary (Biddle & Marlin, 1987). A second limitation lies with the study's research framework which required the student respondents to identify their learning style and their teachers' teaching style. Such a retrospective method of obtaining information could have been biased by both cognitive/memory lapses and intervening events. To the extent that these cognitive/memory-related problems exist, the validity of the study's findings can be called into question.

With the above limitations in mind, the findings from the present study carry a number of important implications for the understanding, and ultimately, for increasing students' academic achievement at Assumption University. First, the finding from the path analysis that employing an external learning style is associated with better academic performance suggests that students should be motivated and trained to employ an external style of learning by their instructors. Students who are external learners like lectures, facts, details, critical thinking, textbooks, and reading. They are logical, analytical and factual. Thus, training these students to focus on a learning style that emphasizes logic, analytical, factual, and critical thinking may lead to their better academic performance. Second, although the present findings showed that an external learning style is associated with better academic performance, the university's management should focus on training students to acquire *any* learning style that can enhance their academic excellence and not to pigeon-hole them into one specific style. That is, students should be made aware of their own learning style, regardless of what that style is. Being aware of whatever works best can only improve their interest in their studies, and ultimately lead to their better academic performance.

In conclusion, it is clear from the findings of the present study that the implications of different learning styles are wide and varied for the students' teachers. More specifically, the challenge for educators is to seriously consider the individual differences in learning and therefore enhance their sensitivity to those differences. With increased sensitivity, educators are more likely to respond to students as individuals who are eager and motivated to learn.

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