

Analysis of Students' Learning Styles to Improve Facilitation of Thinking Skills

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ABSTRACT

This study adopted Grasha-Reichmann learning style scales to identify the learning styles of 61 Thai undergraduate students and to find how the students with different learning styles performed in a case of learning and problem solving skills development in General Education. Out of the six styles that the inventory categorized, only four learning styles were found among the students. While the students who belonged to collaborative styles were the majority, the dependent type made up the minority of the class. The characteristics of the tasks were analyzed based on their potential effect over the student preference. According to the students' performance, the majority of every learning styles achieved at the very good level in the tasks that allowed them to design learning strategy to achieve their goals and received feedback from their teacher regularly. Meanwhile, all students' poorer performance were found in the task which required them to finish within the time limit but without teacher feedback. Instead of judging the student learning based on their styles, this paper would discuss the advantages of teacher feedback cycle over a learner's preference that support the strength and inhibit weakness as shown in the clues out of the reported styles.

Keywords: Learning style, instructional design, thinking skills, general education

Introduction

Aspects of student diversity are useful to consider when designing learner-centered instruction. Among the diversity, learning style is one of the student attribute when consider how much a student learns. A student's primary learning style determines how he or she perceives, interacts with, and responds to the learning environment. Generally, students have different learning styles or diverse preferences for certain types of information and methods of teaching. For example, some tend to learn actively and interactively; others are more inclined to work introspectively and individually. Some like to focus on facts, data, and real-world applications; others are more comfortable with concepts, theories, and mathematical models (Claxton & Murrell, 1987).

The reason why teachers and course designers should pay closer attention to students' learning styles is not only for learning interventions. Knowing students' learning styles could be useful for teaching that aims to develop attitudes and skills for lifelong learning, particularly in relation to 'learning to learn' (Coffield, Moseley, Hall, & Ecclestone, 2004). According to Dunn (1984), learning style assessment can provide the basis for a more personalized approach to student advisement and placement, instructional strategy, and evaluation of learning. However, students' learning style worth studying because it could raise teacher's awareness to address diversity when conduct teaching particularly in mass education system. In this paper, exploration of students' learning styles is for educational development purpose as teachers should diagnose how students learn and

show them how to enhance their learning (Coffield et al., 2004). To balance the different needs and preferences of students and avoid one-size-fits-all approach to instruction, this study explored the concept of learning style in a case of problem solving skills development in General Education at King Mongkut's University of Technology Thonburi-KMUTT. The objectives of the study aimed to identify the students' learning styles and to find how the students with different learning styles performed in the selected tasks.

According to the context of this course, ranges of activities were designed to encourage learning and problem solving skills through active learning strategies. Aligned with the learning goals of General Education which was not discipline-based, the themes of the tasks and the term projects do not rely on the specific body of knowledge. The project was semester-long so that the students had time to practice an inquiry method in ill-defined but real world problems through individual and team based tasks. The students were trained to explore high-impact social problems; practice information literacy; to generate creative ideas by using thinking tools such as SCRAMPER to avoid fixed pattern of mind; to practice critical thinking and reasoning when solved problems. The students also practiced communication skills by visualizing their information, proposing ideas through infographic design, and oral presentation.

Research Questions

This research aimed to answer two following questions: which types of learning styles the students belonged to and how the students with different dominant learning styles performed in each types of tasks.

Theoretical Framework

This classroom research was conducted to assess association between students' dominant learning style that students demonstrated in the classroom context and their performance shown through different types of tasks. The study adopted Grasha-Riechmann Student Learning Style Scales (Riechmann & Grasha, 1974) since the inventory was situation-specific approach and defined around classroom dimensions that could be discussed in relation to the teaching aspects.

Methodology

The subjects of the study were 70 Thai undergraduate sophomore students who enrolled in the course entitled Learning and Problem Solving Skills at KMUTT in the section which the author was a lecturer. Data collection were divided in two parts including survey of students' learning styles and students' scores of the selected tasks. For the first part, the author distributed the questionnaires using Grasha-Riechmann Student Learning Style Scales in the second week of the first semester of 2016 academic year. To test the reliability of the instrument, the students were asked to answer the questionnaires again in the sixth week of the class. The analysis of test-retest reliability from two data sets (four-week interval between testing) showed that the coefficients were 0.87. Only 61 students who reported consistent results of the dominant styles from the two administration were included in the study.

The inventory is a 60-item self-report instrument using a five-point Likert scale. The English-language scales were translated into Thai first. To ensure that there was no erroneous interpretation due to translation, all items were retranslated into English by an English language expert. Next, the English-language version was compared with the original version and necessary changes were made until all items were proved by the Thai and English language experts. Only the students who gave consent to be included in the

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study were asked to rate the extent to which they agreed or disagreed with the items. The higher the score on the inventory, the more a person agrees with the statements about that style.

In the second part of data collection, only three tasks that were individually assigned were included in the analysis. The objectives of the tasks were thinking and learning skill-oriented as illustrated in Figure 1. The scoring rubrics of every tasks were distributed to the students early to make sure that they know teacher's expectation through detailed performance criteria. Finally, the evidences of students' performance of each learning style were quantified from the rubric scores and interpreted as four levels of performance ranging from poor to very good. The findings were shown in descriptive statistics including percentage, mean, and standard deviation. Kruskal-Wallis Test which is non-parametric statistics was used to find the association between students' dominant learning styles and their performances in each tasks.

Tasks	Details	Expected skill development
Learning Assignment	Students independently chose one learning topic, set goals and strategy to achieve them, did their plan, and monitored their own tasks. Students were asked to articulate what they had experienced and wrote a learning log to illustrate both process and results of their activity. The log included before-during-after action review.	Metacognitive strategies Planning and management
Essay	Students wrote essay in the given topic that related to the social dilemma. By gathering essential data from reliable sources, students would make argument and counter-argument with persuasively-stated evidence related to the issue. Students had chances to rewrite their essay and correct mistakes that were guided by teachers' grading according to the scoring rubric.	Analytical thinking Critical thinking Information literacy
Reading Assignment	Students reflected what they had learned and criticized themselves as to what aspects they did well and why. (Only the part of self – reflection in this assignment was used for the analysis).	Critical thinking Metacognitive strategies

Figure 1. Description of tasks and expected skill development

Literature Review

Learning styles are intimately interwoven with the affective, temperamental, and motivational structures of the total human personality (Dun, 1984). It represents person's biologically and experientially induced characteristics that either foster or inhibit achievement. Learning styles have several features in common with approaches to learning and levels of intellectual development, all are context dependent patterns of behavior rather than invariant human attributes (Dunn, Dunn, & Price, 1979; Dunn, Beaudry, & Klavas, 2002; Felder & Brent, 2005). Considering learning as a process, learning style is characteristic preference for alternative ways of taking in and processing

information (Litzinger, Lee, Wise, & Felder, 2007). The term “preferences” are integrated within a number of models of learning styles.

Models have been proposed to identify categories in each style and instruments have been developed to assess the strength of a student's inclination towards one or another category. Certain models that become extremely influential are Dunn, Dunn and Price Learning Styles Inventory (LSI), Kolb's Learning Style Inventory (LSI) and Honey and Mumford's Learning Styles Questionnaire (LSQ). Some instruments are based on Carl Jung's theory on personality type, for example, Myer-Briggs Type Indicator (MBTI) assessment for the workplace (Coffield et al., 2004). The overlaps between different theories, models, and measures in research and practice in the diversity of the disciplines were reported in Cassidy (2004).

Learning style may be considered as a trait which is stable over time or as a state which changes with each experience or situation. Across the continuum of styles, practitioners of fixed traits approaches think that students would be reluctant to move beyond their comfort zones to develop new skills. At the opposite end of the continuum, practitioners of fluid traits approaches see learning styles can be changed over time and may depend upon the specific learning task and context (Hall & Moseley, 2005).

For pedagogical implications, Coffield (2012) noted was that there have been little convincing evidence that showed significant gains in learning when used individualized instruction based on learning styles. Felder & Brent (2005) argued the idea of 'matching instruction' that even if teaching could be perfectly matched to each student's learning style, it shouldn't be. Instead, the goal should be balanced instruction and does not favor one learning style preference over its opposite. Litzinger et al (2007) who developed the Index of Learning Styles based on the fluid trait category believed teachers should strive for balanced instruction. The learning needs of students with all preferences should be addressed to some extent while considering the course subject and on the background and experience of the students. In this respect, student's learning style may provide clues about strengths and areas that might call for additional concentration. This proposition aligns with Kolb's terminology that with or without matching to each student's learning style preferences, the goal of teaching should be to teach in an inclusive manner that helps as many students as possible to succeed (Felder & Brent, 2005).

Grasha-Riechmann Student Learning Styles Scales (GRSLSS)

Grasha T. and Reichmann S.H. (1974) developed the inventory to identify and categorize student learning behavior preferences through measurement of their cognitive and affective behaviors instead of perceptual ones. Rather than studying the relationships among methods, student style, and achievement, they emphasized the increased ability to problem-solve, communicate with others, and organize materials (Curry, 1983). Six general learning styles were defined around three classroom dimensions; student attitudes toward learning, teachers and peers, and reactions to classroom procedures.

This study adopted GRSLSS because its typology is situation-specific approach and the model assumes that style is, to some degree, fluid and changeable according to the learning situation. Also, the inventory was designed to help teacher identifies teaching techniques that address diverse learning styles. Most of all, GRSLSS's proposed work has specific objectives that aligned with this research purpose which looked into the importance of learning style to promote effective learning. There were research described how such characteristics affected students' behavior in many settings. (See more in Grasha & Riechmann, 1975; Hruska & Grasha, 1982; Grasha, 1990; Ferrari et al., 1996). Figure 2 presented brief descriptions and sample items of the six scales.

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Scale	Description	Sample Item
Competitive	Learn in order to perform better than others in the class; expect for the rewards	To stand out in my class, I try to do assignments better than other students.
Collaborative	Cooperate with teacher and peers; share ideas and enjoy working with others	I enjoy discussing my ideas about course content with other students.
Avoidant	Uninterested and not enthusiastic about learning; do not want to be called on in class	I would like teachers to ignore me in class.
Participant	Eager to do the required and optional requirements	I try to participate as much as I can in all aspects of a course.
Dependent	Little intellectual curiosity; learn only what is required; seek teacher and peers for guidelines	I prefer class sessions that are highly organized.
Independent	Prefer to work on their own; like a maximum of choice and flexibility and a minimum of structure	Most of what I know, I learned on my own.

Figure 2. Brief descriptors of Grasha-Riechmann's learning style typology.

Findings

The findings were presented in two main parts. First, table 1 reported frequency and percentage of the students' dominant learning styles which were calculated from their self-score of the GRSLS. Out of the six styles that the inventory originally defined, only four styles were found among the students. The students who had collaborative styles were the majority of this class while the participant style and the independent style presented in a lesser proportion. The students with dependent style had the smallest proportion. No students showed up as an avoidant or a competitive style.

Table 1

Percentage Distribution of the Students' Dominant Learning Styles

Learning style	f	%
Independent	13	21.3
Collaborative	22	36.1
Dependent	11	18.0
Participant	15	24.6
Total	61	100.0

The results of the second part shown in Figure 3-5 focused on the students' learning styles and their performance of selected tasks during the learning experience in this class. The comparison within tasks indicated that the performance of students with different learning styles were quite closed. In Reading Assignment, the majority of every styles performed at the moderate level whereas none of them performed at the very good level. The minority of every styles had poor performance except for the independent style whose many of them had poor scores in this task.

In Essay Writing and Learning Assignment, proportions of the independent, the collaborative, and the dependent learners in each performance level almost ranked in patterns. In both works, the majority of every learning styles were found having the very

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good performance level. Also, few of all types performed poorly in the two tasks. A small difference was found in the numbers of students who had moderate and good level scores.

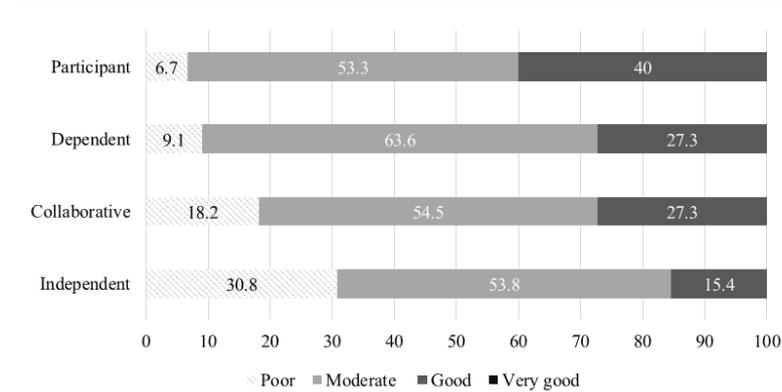


Figure 3. Percentage Distribution of Students' Performance in Reading Assignment

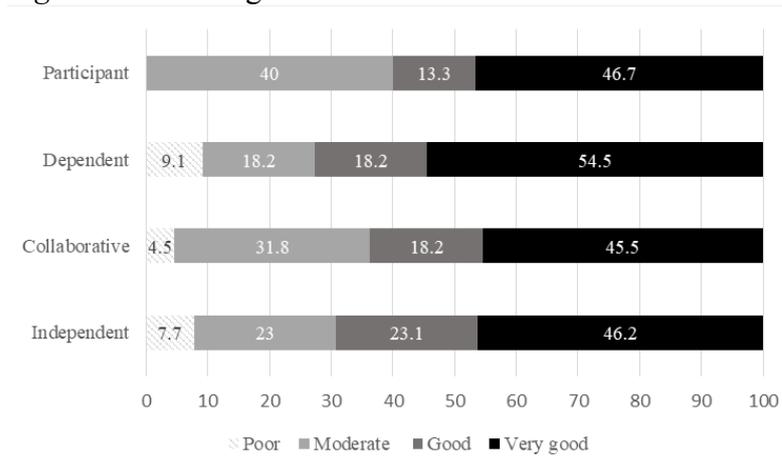


Figure 4. The percentage of performance level of the students

Figure 4. Percentage Distribution of Students' Performance in Essay Writing

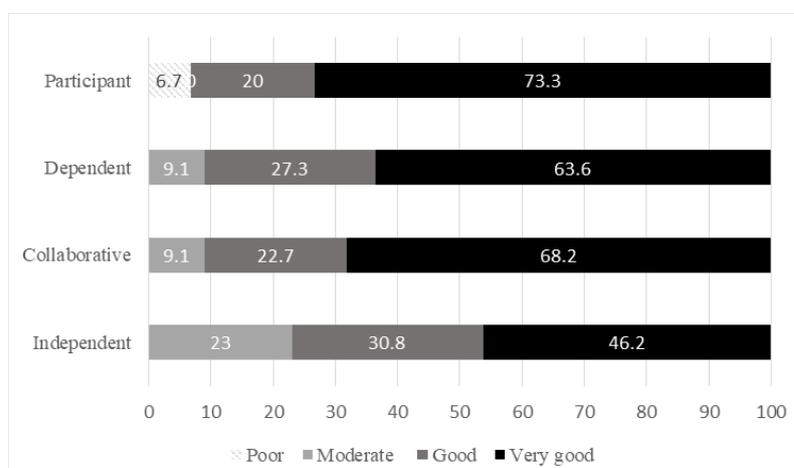


Figure 5. Percentage Distribution of Students' Performance in Learning Assignment

Table 2 showed that the dependent learners had the highest average scores of Essay Writing (Mean=8.66, SD=1.89) and Learning Assignment (Mean=9.00, SD=1.02). The participant learners had the highest average scores of Reading Assignment (Mean=11.23,

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SD=1.43). The independent style had the lowest scores of Reading Assignment and Learning Assignment (Mean=9.83, SD=1.74; Mean=8.38, SD=.94 respectively). Meanwhile, the participant style gained the lowest scores of Essay Writing (Mean = 7.98, SD=1.80).

Table 2

Mean Scores, Standard Deviation (SD), and Median Scores of Students' Performance

Learning Style	Reading Assignment		Essay Writing		Learning Assignment	
	Mean (SD) (Out of 15)	Media n	Mean (SD) (Out of 10)	Media n	Mean (SD) (Out of 10)	Media n
Independent	9.83 (1.74)	9.83	8.36 (1.82)	8.89	8.38 (.94)	8.58
Collaborative	10.73 (1.79)	11.12	8.24 (1.84)	8.91	8.95 (.87)	9.05
Dependent	10.71 (1.55)	11.33	8.66 (1.89)	9.00	9.00 (1.02)	9.16
Participant	11.23 (1.43)	11.00	7.98 (1.80)	8.89	8.90 (1.92)	9.50
Total	10.65 (1.68)	10.85	8.82 (1.23)	9.02	8.27 (1.80)	8.92

Table 3 presented the result of Kruskal-Wallis H test. At an alpha level of .05, there was no statistically significant difference in performances between the students with different dominant learning styles (χ^2 (3, N=61) = 4.650, p =.199 for Reading Assignment; χ^2 (3, N=61) = 5.497, p = .139 for Learning Assignment; χ^2 (3, N=61) =.959, p = .811 for Essay).

Table 3

Kruskal-Wallis H Test of Students' Performance and Their Dominant Learning Styles

Types of Tasks	Chi-Square	df	P -value
Reading Assignment	4.650	3	.199
Essay Writing	.959	3	.811
Learning Assignment	5.497	3	.139

Discussion

The results showed that the difference of students' learning styles did not determine advantages or disadvantages imposed upon their performance. Within-task analysis found no particular styles showed an outstanding performance. This meant each learning styles were not more or less likely to perform better than others significantly. However, the analysis of student performance when compared between-tasks indicated some similarities which could be due to the characteristics of the tasks that promoted skill development without addressing any particular learning styles. As learning style is situation-specific, the results suggested that it was more likely that the essential elements of the tasks impacted the student performance than the learning styles did. The findings in this study supported the previous work of Demirbas and Demirkan (2007) who found the better performance of converging students in the Basic Design course could be due to the characteristics of the course. Since design is considered as a problem solving, then the course provided learning experiences in favor of converging students rather than divergers who are interested in gathering information and not systematic in problem solving.

There was an observation emerged from the evidence that the elements of giving feedback yielded benefit to students of any learning styles. According to Engle and Conant (2002), engaged forms of student participation depend on the classroom evaluation that

emphasize mastery, progress and improvement so that students will come to value learning for its own sake. The more students engage with the activities, the more tendency of their effective learning (Azevedo and Sherin, 2012). In Learning Assignment and Essay Writing, students had the opportunity to correct their work and were guided by teacher's comments according to the given scoring rubric. In Essay Writing, the students had chances to review and rewrite their work; in Learning Assignment, the students were allowed to revise their learning strategies and received teacher feedback during their ongoing process. Even the independent learners, who prefer to work on their own, had benefit on this learning cycle. For the students who generally participate, collaborate, and seek teacher for guidelines, these steps made the tasks even more engaging and motivated novice learners to develop their potential.

In contrast, it was observed that Reading Assignment was the only task which did not give students the opportunity to correct mistakes and resubmitted their work and the majority of every styles performed at the moderate level. The potential explanation was that Reading Assignment lacked the elements that helped students effectively learn - sufficient teacher feedback. When situations provide clear and unambiguous cues about what people should do, personality characteristics fall into the background (Mischel, as cited in Grasha & Yangerber-Hicks, 2000). While the grading criteria of the other two tasks were for formative purposes, the scoring of Reading Assignment was only for summative assessment. Once the teacher only did summative assessment, even students who were proficient self-directed learners would have more difficulty to learn within the time limit at their own pace. In this environment, the teacher took risk by assuming that certain types of students would be good participant and work on their own or students who tend to have curiosity to learn would put enough effort and commit to learn at their best.

Limitation

The concepts of learning styles was extensively based on the context and the results of this study were interpreted based on evidences of the specific elements of the tasks within the small number of population of the study. Consequently, the pedagogical implications did not represent the association of learning style and teaching or facilitation of other thinking and learning skills.

Conclusion

The results showed that the difference of students' learning styles did not associate with student development of thinking skills. However, it was observed that students' higher performance were found in the tasks which involved them in the feedback loop. According to Grasha, A. F., & Yangerber-Hicks N. (2000), even though certain patterns were found when the students with high participant learning styles were less likely to receive lower grades and having a more collaborative style was a little more helpful in receiving an A in the traditional course. However, those grades were more likely to be affected by the stylistic differences among teachers.

This paper stands for the proposition that learning style depends on the context or specific learning task. Once the teachers acknowledge the student diversity, they should take into account that such variety might be instable. Teacher should take benefit of knowing students' learning style by varying their teaching or facilitation approach to support students' strength but inhibit their possible weakness that emerged from their style. For example, although the difference of student learning styles did not determine the advantages or disadvantages imposed upon their achievement, the evidences that showed the lowest average scores of independent learners in two types of tasks indicated that these students required balancing of the student-centered teaching approach. This yield useful

information for teacher to adopt alternative teaching strategy. For instance, using delayed feedback allows the independent styles to think for themselves first and receive comments and guidelines from teacher later. The scaffolding strategy could help students to be more open to teacher feedback while encourage them to be self-driven through their preferred style. Encouraging the independent learner to work with others, share ideas and give feedback to their peers could be also complements to teacher facilitation. For the dependent styles who generally opt for teacher - centered classroom methods, involving them in the repeated cycle of practice and give them feedback means less disruptive for them. Therefore, giving them an individual task and require them to be more self-directed would be more appropriate facilitation to help dissolve their weakness.

The knowledge of learning style is one of the fundamental aspects of teaching that reduces teacher-centeredness instruction. In this research, knowing students' learning styles did not aim to satisfy their preferences but gives teachers guidelines to foster the inclusive learning environment. The sooner the teachers know student learning style, the better the knowledge of learning style is practical. As Charkins, O'Toole & Wetzel (1985)'s findings in economics course that the greater the divergence between learning and teaching styles, the lower the students' achievement gain and the less positive the students' attitude toward economics. However, the knowledge of learning style should be interpreted carefully. The teachers must not assume that student whose preference aligned with certain nature of the tasks need less guidance and be able to do better at the tasks than their peers with other styles.

One of the most important aspects of learning style is context-based characteristics and people generally possess a variety of characteristics to different degrees. Therefore, it is adaptability skill that students should have without making an excuse of their preferences. For example, collaborative learners still require the practice of collaborative skills; independent learners should learn more about how to be self-directed in creative way while do independent learning activities; dependent learners should take more risk to be self-initiative and become more independent. Overall, an awareness of learning style is meaningful when it is used as a self-development guideline for both teacher and student.

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