Learning through the Variation Theory: A Case Study

Eddie W. L. Cheng
The Hong Kong Institute of Education

The variation theory stems from the concept of phenomenography. Although some applications of the theory can be found, the theory is not well known in the field of education, especially with respect to the teaching of business and management subjects. The aim of this paper is to explore the use of the variation theory for teaching management concepts. A case of designing an educational setting for learning two easily confused theories of knowledge management was presented. With the intended object of learning, the educational setting was divided into three parts, based on which students experienced the four patterns of variation (i.e., contrast, separation, generalization, and fusion) by using their own generated examples. The theory helps students draw upon their personal experiences and discern learning from different perspectives.

The variation theory stems from the concept of phenomenography. Since its emergence in the late 1990s (Marton & Booth, 1997), the theory has quickly become one of the most famous instructional approaches. The theory is useful in education as it helps teachers learn to discern learning from different perspectives, and it can be used to address individual differences in the classroom by allowing students to draw upon their personal experiences and apply them in their learning (Ornek, 2008). Accordingly, the variation theory can contribute to the design of pedagogical settings for teaching large classes (Gu, Huang, & Marton, 2004) as it helps to deal with students' diverse abilities, which, according to Cheng, Tang, and Cheng (2014), has long been the core issue in education.

Although some applications of the theory can be found, such as teaching computer programming (Thuné & Eckerdal, 2009) and Chinese characters (Ho, 2014), the theory is not widely applied for improving teaching, especially with respect to business and management subjects. Its lesser popularity can be explained by the fact that the importance of teaching is underestimated. Without paying attention to the complex nature of learning and the presence of individual differences in pedagogical understanding, teachers only perceive teaching as "a relatively straightforward task rooted in the notion of delivering information" (Loughran, 2009, p. 189). Such an "out-of-focus" perception should not be an obstacle preventing the introduction of useful teaching theories that can enhance students learning.

In order to increase the application of the variation theory, more examples from different disciplines should be demonstrated. Therefore, this paper aims at exploring how the theory can be employed to improve the teaching of management theories by reference to a case study example. Such a case study approach is referred to as "learning study" by Marton and Lo (e.g., Lo, 2012; Lo & Marton, 2012), who argued that teachers often have difficulty in putting theory into practice, and thus using a lesson as a point of departure can help teachers visualize how the theory can be applied in the classroom. It is perhaps the first paper to demonstrate the use of the variation theory in teaching easily confused management concepts. The writing of this paper was challenging and rewarding because all the concepts of phenomenography, variation, and transfer of training can be integrated in the pedagogical setup. In the following sections, some basics about the concepts and theories are provided. The teaching strategy for an object of learning is then presented to illustrate how the concepts and theories can be applied in a real context.

Background Theories

Phenomenography

Phenomenography refers to "the qualitatively different ways in which people are aware of the world, and the ways in which they experience various phenomena and situations around them" (Marton & Pang, 2008, p. 535). In a pedagogical setting, teachers should identify the multiple conceptions students have regarding a specific phenomenon because different students may experience a phenomenon in various ways. As phenomenography is known to be empirical in nature or, more specifically, qualitative in nature, teachers should study the awareness and reflections of the students (Marton & Pang, 2008). This process is referred to as "bracketing", which means that the teacher should let a student approach a particular topic using his or her own way of experiencing it without any input from the teacher's perspective (Ornek, 2008, p. 3).

The way of experiencing a topic is twofold (Booth, 1997; Marton, 1986). First, it is a way to separate the phenomenon from its context (i.e., external horizon), and second, it is a way to associate the phenomenon with its essential parts (i.e., internal horizon). As such, it is the student who determines the parts of the phenomenon that should be moved to the background

and the parts that should be brought into focal awareness. Except for those critical aspects of the phenomenon brought into focal awareness (e.g., the theme), all the remaining aspects are retained in the thematic field. The critical aspects form the core for developing understanding and experience. Learning occurs when the critical aspects of the phenomenon vary, thereby allowing variations to be brought into focal awareness.

Variation Theory

Variation theory explains that individuals see, understand, and experience the world from their own perspectives (Orgill, 2012). Therefore, students may not learn effectively if they are not aware of things in exactly the same way as the teacher (Lo, 2012). However, the theory is suitable to improve learning by helping students develop their own ways to experience the phenomenon (or the object of learning). Learning takes place when a student is "capable of being simultaneously and focally aware of other aspects or more aspects of a phenomenon" (Marton & Booth, 1997, p. 142). Marton, Runesson, and Tsui (2004, p. 7) referred to this as "powerful ways of acting" being derived from "powerful ways of seeing". Lo (2012) supplements that teachers should help students develop "powerful ways of seeing" so that students can become more independent in dealing with new problems and issues in the future.

The theory envisages that for learning to occur, some critical aspects of the object of learning must vary while other aspects remain constant (Ho, 2014; Ko & Marton, 2004; Marton & Booth, 1997). It further suggests that how students perceive a specific object of learning depends on what pattern of variation is provided by the teacher. It is expected that different patterns of variation result in different types of learning. According to Marton and colleagues (2004, pp. 16-17), there are four patterns of variation: contrast (i.e., recognizing values of an aspect), generalization (i.e., experiencing varied appearances of the same value), separation (i.e., separating aspects with varying values from invariant aspects), and fusion (i.e., experiencing several critical aspects simultaneously). Lo and Pong (2005, p. 21) refer to them as "possible functions". In such a learning study approach (Marton & Pang, 2008), teachers should be able to construct learning instructions and activities for students to experience and discern a particular pattern of variation that can strengthen their learning of the object of learning.

Transfer of Learning

To ensure that students have learned what was intended for them to learn, evidence of the transfer of learning must be collected. Transfer of learning is defined as the extent to which learned knowledge and skills are being applied to other situations (Noe, 2012). This can also be referred to as positive transfer (Mariano, 2014). According to "the doctrine of sameness", the learner who has learned to do something in one situation may be able to do the same thing in another situation, given the perceived similarities between the two situations (Marton, 2006, p. 499). This represents an emphasis on the general principle that can be applied to similar situations. Thus, such a near transfer of learning is about relationships between situations that are perceived to be related through similarities (Mariano, 2014).

However, from an educational perspective, "it appears more fruitful to consider the case when the learner, having learned to do something in one situation, might be able to do something *different* in other situations, thanks to perceived *differences* between situations" (Marton, 2006, p. 499). This later argument draws attention to the question of "how situations are related through differences". By discerning such differences between situations (similar to the varying appearances in the concept of *generalization*), learners can adapt what they have learned to different situations, enabling the so called far transfer of learning. Therefore, researchers have suggested that learners be presented with more situations during the learning experience (e.g., Reeves & Weisberg, 1994). Yet, such instances must be experienced simultaneously even though they are encountered at different points in time. Marton and colleagues (2004, p. 17) refers to this as "diachronic simultaneity."

The Case Study

In this section a case is presented to illustrate the use of the variation theory. Using a case as a real-life example to report evidence is one major application for the case study approach (Gillham, 2000; Yin, 2009). Case knowledge is argued to be central to human learning (Flyvbjerg, 2006). As noted by Powell (2013), readers can "feel" about the case and make their own generalizations about the experience reflected in the case (the so called *naturalistic generalization*).

In the present study, a single-case study methodology was employed. This methodology is a type of qualitative research, which can be defined as "any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification" (Strauss & Corbin, 1990, p. 17). It helps to extend the understanding of a phenomenon when little is known about it (Hoepfl, 1997). The present case study played a supportive role in facilitating the understanding of the topic being

studied, the variation theory (Baxter & Jack, 2008). Yin (2009) referred to the case study as descriptive, while Stake (1995, 2006) referred to the case study as instrumental. The qualitative analysis was based on the evidence converged from direct observations in the classroom and students' work (aka physical artifacts; Gillham, 2000; Morse & McEvoy, 2014). Because the variation theory focuses on taking students in the center (Lo, 2012), the analytic strategy includes certain aspects of the student-centered approach, such as whether the teaching method can improve student involvement and discussion in class (Abdelmalak & Trespalacios, 2013; Jones, 2007).

The Participants

The participating students (*n* = 38) were enrolled in a module of knowledge management at a higher education institution. The part of a lesson observed involved the teaching of the two theories of knowledge. In this case study, students were divided into several groups, and each group consisted of four to five students. However, no specific arrangement was made for grouping students. Although differentiation among students in terms of their backgrounds is sometimes considered in the selection of the participants and in the composition of the groups, homogeneous and heterogeneous groups have possessed specific functions (Toy & Ok, 2012). The former may take advantage of students' shared experiences, while the latter may capitalize on different perspectives in a case (Kitzinger, 1995).

The Pedagogical Setting

This case is about the teaching of two easily confused knowledge theories. As noted by Åkerlind (2008), the variation theory changes a teaching and learning event from a teacher-centered to a student-centered approach to understanding the phenomenon through variations in student experience. While reporting the case in the following paragraphs, relevant concepts from the variation theory are mentioned in various parts so that readers are able to link theory into practice. The educational setting introduced in this section is appropriate to be adopted for university teaching.

Background of the Object of Learning

The intended object of learning included two theories of knowledge management. This is "the object within the teacher's awareness" (Huang & Leung, 2005, p. 36). The two theories, which were different classifications of knowledge, were (1) embedded and migratory knowledge (Badaracco, 1991), and (2) tacit and explicit knowledge (Nonaka & Takeuchi, 1995). In the conventional pedagogical setting, the two theories

were taught separately with definitions of the theories being given to the students and examples being provided by the teacher to illustrate the difference between the two terms with respect to each theory. After the lesson, however, some students exhibited confusion between the two theories when they completed an exercise on the flow of knowledge. For example, some students believed that tacit knowledge and embedded knowledge were the same, while migratory knowledge was mainly explicit.

Conversely, the real principle is that tacit knowledge can be embedded or migratory, as can explicit knowledge. On the other hand, embedded knowledge can be tacit or explicit, as can migratory knowledge. Even when students were informed of such relationships, some still used wrong examples when demonstrating their understanding of the theories.

In this case, a pedagogical setting was developed to improve student understanding of the two theories. According to Mok (2003), this enacted object of learning refers to how the teacher structures the lesson in such a way that the students are aware of the intended object of learning. This setting consists of three steps. The first step was to teach the two theories one by one using examples. The second step was to illustrate the difference between the two theories using examples. The third step was to test student understanding by way of exercises. Moreover, students were divided into several groups whereby each group focused on a particular type of organization. For example, Group A was assigned a bank, Group B focused on a supermarket, Group C was ascribed a university, etc.

Teaching the Two Theories Separately Using Examples

This step had two tasks. The first was to discuss about how an organization should address knowledge, and the second involved the teaching and learning of the two theories in combination with the theory of variation. Through discussion, the "space of learning" could be clarified in such a way that students were able to identify the critical aspects wherein each theory of knowledge was an aspect. A learning event was then designed that enhanced student awareness of the presence of theories and allowed the students to understand the theories through their experiencing process. According to Marton and Booth (1997, p. 84), this refers to "direct object of learning" (i.e., the "what" behind the learning). For this learning to occur, the following questions were asked by the teacher:

1. Why is knowledge important to an organization? This question leads students to think about the function of knowledge in an

organization. For example, knowledge can be used to support the organization's operations, and it can also be used to help customers know more about the organization's products.

2. How can knowledge be obtained? As an extension of the first question, this question helps students understand that knowledge can flow into and out of the organization's boundaries.

3. What knowledge is needed for the specific organization assigned to your group? Based on the first and second questions, students are required to provide examples about knowledge that flows into and out of the organization. Additionally, they must identify the sources of such knowledge.

With the above three questions as a foundation, students were encouraged to think about what and how knowledge moved throughout, into, within, and outside an organization using their own examples. Such "student-generated examples" were essential for concept development as students were able to see a pattern in their examples as well as in the examples of others (Watson & Mason, 2002, p. 247). In this lesson, general examples, which were easily drawn, were sufficient for demonstrating that the students had learned and understood the two theories. Possible conclusions from the qualitative analysis were summarized as follows:

- Knowledge could flow into and out of an organization. Examples of knowledge flowing out of the organization include banking procedures for applying for personal loans, brochures about product information, and prices of products in a supermarket. Examples of knowledge flowing into the organization include the financial information about the economy that is supplied by the government to the bank and the wholesale prices of products from wholesalers for a supermarket. Examples of knowledge circulating within the organization include announcements to employees, notifications of promotions and/or redeployment of staff, and changes of policies.

- Knowledge could remain in private to the individual, or it could be kept by the organization. Examples of private knowledge that resided within one's mind include how a university professor teaches his or her students and how a supermarket manager handles customers' complaints. Examples of knowledge kept by the organization include the ordinances to be followed by a bank's employees and the supermarket's rules about the etiquette for dealing with customers.

- Knowledge could be kept within an organization, or it could be shared with parties outside the organization. Examples of knowledge kept within the organization include salary information of employees at a university and the product cost details of a supermarket. Examples of knowledge shared with parties outside the organization include personal and mortgage loan interest rates in a bank and tuition fees for programs in a university.

The two theories and their examples used by the students illustrated the differences between the two concepts of each theory. Similar to conventional teaching methodologies, the two theories were introduced separately to the students. Following the concept of "experiencing learning" (Marton & Booth, 1997, p. 91), this lesson first addressed the "what of learning" (i.e., the direct object of learning). With respect to the first theory, embedded knowledge and migratory knowledge were two opposite concepts (i.e., the meaning aspect of student experience). To discern how the two concepts differed from each other, the structural aspect of student learning was emphasized. Hence, embedded knowledge could be distinguished from migratory knowledge based on an example from the students. By comparing different experiences (i.e., the theory of contrast), students could understand the values of the critical aspect (i.e., the two concepts of each theory) in terms of their given examples.

Use mortgage loan interest rate of a bank as an example. The teacher asked why a bank needed to disclose its mortgage loan interest rate to the customer. The teacher then asked what would happen to the bank if the mortgage loan interest rate was not disclosed to the customer. Based on these two questions, students began to understand the difference between the two situations (experiences) with respect to the mortgage loan interest rate. Examples from other students were then used until the students were able to discern the difference between the two values (i.e., the two concepts) of the critical aspect (i.e., the theory). The same method was used to teach the two concepts of another knowledge theory (i.e., explicit and tacit knowledge).

Illustrating the Difference Between the Two Theories Using Examples

In the previous setting, students discerned the direct object of learning (the understanding of the two theories). Now, the emphasis turned to the "how of learning" (i.e., the indirect object of learning and the act of learning). This section is about the indirect object of learning, while the next section is about the act of learning. Similar to the previous section, students knew

that the two theories represented two different classifications (i.e., the meaning aspect of their experience). However, they did not understand how these two classifications differed. Focusing on the structural aspect of their learning, the concept of variation (*separation*) was applied to help students discern the difference between the two theories by use of the examples that they created in the first part. Figure 1 illustrates "the space of variations" (Marton et al., 2004, p. 21) that help determine the educational setting appropriate for the comparison of the two theories of knowledge (i.e., the critical aspects of the object of learning).

As shown in Figure 1, four situations were identified from the two sets of theories:

- Tacit knowledge that could be migrated (i.e., tacit-migratory) or migratory knowledge that was tacit in nature (i.e., migratory-tacit).
- Tacit knowledge that must be embedded (i.e., tacit-embedded) or embedded knowledge that was tacit in nature (i.e., embedded-tacit).
- Explicit knowledge that could be migrated (i.e., explicit-migratory) or migratory knowledge that was explicit in nature (i.e., migratory-explicit).
- Explicit knowledge that must be embedded (i.e., explicit-embedded) or embedded knowledge that was explicit in nature (i.e., embedded-explicit).

Using their specific organization, Students were then told to identify examples of the above four situations. For example, in the tacit-migratory situation, each group of students must find from its assigned type of organization an example that while the knowledge was in tacit form, it could be moved out of the organization. A list of examples for the four situations is in Table 1.

In addition, the arrows shown in Figure 1 indicate that there are four comparisons among the four concepts of the two theories. Such comparisons facilitated student discernment with respect to the aspects of the specific object of learning by separating the similar (or invariant) from the different (or variant) aspects (Marton et al., 2004):

- Comparing embedded and tacit knowledge: To enable this comparison, three previously identified situations were used. Either embedded or tacit knowledge should be kept constant, while examples should be provided for each of the two categories of the other theory. Thus, there were two examples of embedded knowledge, one each for the embedded-tacit and embedded-explicit situations, and two examples of tacit knowledge, one each for the tacit-embedded and the tacit-migratory situations. However, because the embedded-tacit and tacit-embedded situations were identical, only three examples were necessary.

- Comparing migratory and tacit knowledge: Similar to the previous comparison, there were two examples of migratory knowledge, one each for the migratory-tacit and migratory-explicit situations, and two examples of tacit knowledge, one each for the tacit-embedded and tacit-migratory situations. Because the migratory-tacit and tacit-migratory were identical, only three examples were needed.

- Comparing embedded and explicit knowledge: Similarly, there were two examples of embedded knowledge, one each for the embedded-tacit and embedded-explicit situations, and two examples of explicit knowledge, one each for the explicit-embedded and explicit-migratory situations. Because the embedded-explicit and explicit-embedded situations were identical, only three examples were required.

- Comparing migratory and explicit knowledge: Similarly, there were two examples of migratory knowledge, one each for the migratory-tacit and migratory-explicit situations, and two examples of explicit knowledge, one each for the explicit-embedded and explicit-migratory situations. Since the migratory-explicit and explicit-migratory situations were identical, only three examples were necessary.

Class discussions that focused on each of the four comparisons were conducted until all students were aware of the values of the various aspects being compared. For example, consider the comparison between migratory and explicit knowledge. This specific example is chosen for this case study due to the misunderstanding among students that the two concepts were similar. However, because migratory and explicit knowledge belonged to two different theories, they could not be directly compared. Therefore, the teacher first held migratory knowledge as a constant (i.e., an invariant aspect) and compared the tacit and explicit values of the examples about the migratory knowledge.

As shown in Table 1, for the group of students who were assigned the organization of "banking," the migratory-tacit example was "bank managers' advice given to customers about investment options," while the migratory-explicit example was "bank's loan application procedures shown to customers." Thus, students were aware that any migratory knowledge could take either an explicit or a tacit form, and they should not confuse the two concepts. Their

Table 1
A List of Examples of Different Organizations

Type of organization		Embedded	Migratory
Bank	Tacit	Personal knowledge of bank managers in handling customers' complaints	Bank managers' advice given to customers about investment options
	Explicit	Bank's policies to be applied within the bank	Bank's loan application procedures shown to customers
Supermarket	Tacit	Managers' knowledge about which brands are more popular in the supermarket	Managers' advice given to subordinates on how to deal with customers
	Explicit	Products' costs charged by wholesalers	Prices of products shown to customers
University	Tacit	Professors' knowledge about their research	Professors' teaching in classes
	Explicit	Professors' employment contract details, such as salary, contract terms, etc.	Professors' research published in journals

Figure 1
Comparison of the Two Theories of Knowledge
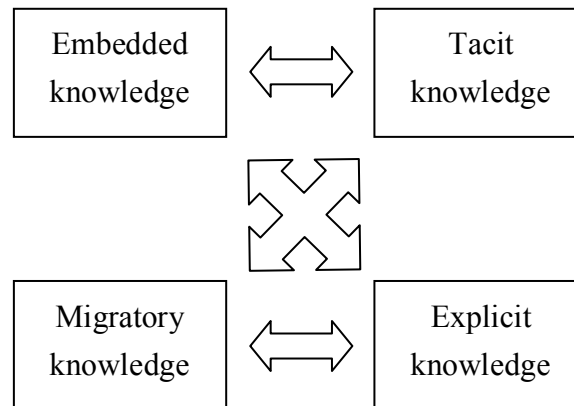
understanding could then be reinforced by further experiencing the two examples regarding the varying values (the embedded and migratory forms) of the explicit knowledge (see Table 1).

Further enhancement of discernment, including the generalization of the values of a critical aspect, was obtained by incorporating the examples from other types of organizations, such as the supermarket and university. Specifically, different examples for the same situation (see Table 1), which were referred to as the varying appearances or instances, were experienced simultaneously by the students to facilitate the transfer of learning.

Testing Students' Level of Understanding With Exercises

The aim of this section is to present how students' level of understanding was tested with the exercise provided by the teacher. Moreover, the results from the

test and the observation in the classroom are presented and discussed.

The act of learning requires students to apply what they have learned by doing the exercise. Their newly acquired ability from the previous experiences is referred to as their "lived object of learning" (Marton et al., 2004, p. 22). In the lesson, the *fusion* concept was applied to an exercise that aimed to assess the level of the students' understanding of the intended object of learning. This exercise consisted of five questions. Each question required students to provide two correct answers. A sample of the exercise is shown in Figure 2. Moreover, the teacher guided the students to reflect on their understanding of the knowledge theories applied in different contexts of the questions in the exercise. For example, with respect to the fifth question (see Figure 2), the teacher asked what types of knowledge could be identified during a meeting, and the students responded with their own experience. More in-depth post-lesson discussion of critical features from real-life examples should be part of the learning study (Lo, 2012).

Results and Discussion

The results of the exercise were compared with those of previous cohorts to determine whether the students had improved in learning the theories. Compared with those of previous cohorts, students of this cohort were found to have a better performance in completing the exercise. For the previous cohorts, there were approximately 40% of the students choosing the correct answers for all questions. Some students (approximately 25%) chose one or two incorrect answers, while a few students (approximately 5%) chose more than four incorrect answers. In the present cohort, approximately 80% of the students answered all the questions correctly. No students chose more than four incorrect answers. By using their own examples and designing the pedagogical setting based on the patterns of variation, students showed substantial improvement in their learning of the two knowledge theories.

Moreover, students were observed throughout the whole session. In addition to their favorable results in the exercise, the students were shown to be more positive in certain aspects of student-centered learning compared with those of the previous cohorts. Abdelmalak and Trespalacios (2013) argued that the student-centered approach can motivate students to spend more time and effort on a lesson. The present cohort has similar achievements to the variation theory. First, students paid more attention to the two knowledge theories and were more interested in identifying their own examples. This allowed them to concentrate on learning the theories. Those students

Figure 2
Sample Questions

Read the following questions and choose the type of knowledge that best describes each underlined situation.	Tacit	Explicit	Embedded	Migratory
1. The marketing manager told his subordinate <u>to print the product brochure</u>	[ ]	[x]	[ ]	[ ]
<u>to be distributed on the shop floor</u>.	[ ]	[ ]	[ ]	[x]
2. Among all students, only Peter <u>knows the answer</u> for the question,	[x]	[ ]	[ ]	[ ]
but he <u>doesn't tell others</u>.	[ ]	[ ]	[x]	[ ]
3. Calvin goes to the playground <u>to watch David playing football</u>	[ ]	[ ]	[ ]	[x]
and <u>imitates how to kick the "banana shoot"</u>.	[x]	[ ]	[ ]	[ ]
4. The teacher has mentioned that <u>the marking scheme of the examination</u>	[ ]	[x]	[ ]	[ ]
is <u>not supposed to be given to students</u>.	[ ]	[ ]	[x]	[ ]
5. After the meeting, the manager <u>told the chief executive officer</u>	[ ]	[ ]	[ ]	[x]
about the <u>decision made</u> by the team.	[ ]	[x]	[ ]	[ ]

who were less motivated were encouraged by other members to contribute to group discussion. This is an effective way to overcome resistance from those students with less learning motivation (Jones, 2007). Second, they were actively involved in addressing the teacher's questions. As those questions were posed to connect student examples to a particular situation, students not only spent more time but also participated more actively in discussion, resulting in being more committed to the lesson. Researchers have already linked effective learning to the time devoted in class toward interaction (Weimer, 2002) and active involvement in the classroom (Wagenaar, Scherpbier, Boshuizen, & Van der Vleuten, 2003). Third, they were more confident when completing the exercise. Compared with those of previous cohorts, students in the present cohort were more enthusiastic toward answering the questions. Students with this perspective are involved in a process of learning through persistent effort (Cook, 1992). As a consequence, students' individual differences in learning styles were shown to be effectively met by the variation theory (Lo & Pong, 2005).

Conclusions

This paper introduces the variation theory and uses it to develop an educational setting that helps students learn two theories of knowledge management (i.e., the intended object of learning). Students used their own generated examples to compare the concepts of the two theories. Moreover, comparisons between the examples supplied by different groups enabled students to examine one critical aspect by cross-referencing different examples, enhancing their discernment and learning of the principle, and thereby improving their ability to generalize or transfer their learning to other situations. Such a pedagogical design draws on student-centered principles which "encourage students to take responsibility for their own learning" and "invite (them) to have more power over that learning" (Abdelmalak & Trespalacios, 2013, p. 329). The study implies that increasing student involvement in classrooms may result in more effective learning (Wagenaar et al., 2003). However, the results of the case indicate that a few students have not fully understood the theories. As noted by Lo (2012, p. 119), making use of the patterns of variation does not guarantee that all students will learn. It is the quality of the teacher's manipulation that determines the success of student learning (Tong, 2012). This finding identifies the need for a teacher's ability to integrate the variation theory into the lesson. One critical aspect may be whether the teacher can ask questions in a way that allows the students to account for their actions within their own frame of reference

(Entwistle, 1997). The variation theory, therefore, guides the teacher toward proper pedagogical design that can help students discern the object of learning.

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EDDIE W. L. CHENG currently works as an assistant Professor in the Department of Social Sciences at The Education University of Hong Kong (formerly known as The Hong Kong Institute of Education). He teaches business-related subjects, including project and knowledge management, at both undergraduate and postgraduate levels. His research interests include teaching and learning in business subjects, performance in field experience, online educational technologies, and educational psychology.