

THE PERCEPTIONS OF STUDENTS WITH DIFFERENT LEARNING PREFERENCES  
REGARDING THEIR LEARNING EXPERIENCES IN A UNIVERSITY CLASSROOM  
THAT INCORPORATES INSTRUCTIONAL STRATEGIES FOR DIVERSE LEARNERS

A THESIS SUBMITTED TO THE GRADUATE DIVISION OF THE  
UNIVERSITY OF HAWAII AT MANOA IN PARTIAL FULFILMENT OF  
THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF EDUCATION

IN

EDUCATION PSYCHOLOGY

MAY 2013

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Keywords: CREDE, CREDE activity center tasks, the Learning Style Inventory, learning preference congruent teaching

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## **Acknowledgments**

I would never have been able to complete my master's thesis without the help of my committee members, my colleague, the Hay Group, and the students of EDEP 201 who served as the participants of this study.

I would like to express my deepest gratitude to my thesis advisor, Dr. Yamauchi, for supporting my research ideas on learning preferences, allowing me to study her class, and providing me with consistent informal as well as formal feedback. I would also like to thank Dr. Enomoto and Dr. Wyatt who offered many useful suggestions on improving this study. My grateful thanks are also extended to my colleague, Lance D. Jackson, for his help in organizing research ideas and contributing new perspectives to my research.

Finally, I would like to thank the students of EDEP 201 who volunteered to participate in this study and the Hay Group for providing the Learning Style Inventory, which was used to identify the participants' learning styles.

### **Abstract**

This study investigated the extent to which the use of the Center for Research on Education, Diversity, and Excellence (CREDE) model facilitated learning preference congruent teaching, which I defined as instruction that seeks to maximize the utility of incorporating practices that take advantage of students' learning preferences into the educational process. The research questions were: How effectively do CREDE activity center tasks accommodate students with different learning preferences? How is the learning preference congruence of center tasks related to students' perceptions of center tasks? The learning styles of 16 undergraduates, in an introductory teaching course that used the CREDE model, were evaluated using the Learning Style Inventory. All data obtained from classroom observations, semi-structured individual interviews, and focus group interviews were analyzed using open and axial coding. The results showed the CREDE course facilitated learning preference congruent teaching to some extent, but not completely. Additionally, the center tasks that accommodated the participants' learning preferences were perceived more positively by the participants.

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## **Introduction**

### **Problem and Significance**

Educational systems that employ strategies and methods that only benefit students with certain learning preferences disenfranchise students with other types of learning preferences (Lovelace, 2005). The Korean educational system is an example. The Korean educational system uses a very limited number of instructional strategies and methods, when the breadth of possibilities is considered (Rao, 2011). Even though a movement emphasizing the importance of student engagement is slowly taking place, the Korean educational system still remains highly teacher centered and lecture focused, rarely incorporating presentations, discussions, and small group projects. The strategies used in the Korean educational system favor students who are auditory learners and students with a high affinity towards reading and writing (Zimmerman & Dibenedetto, 2008).

The Korean educational system is not the only educational system that has an instructional design that favors specific types of learners. I have observed that the American educational system under the No Child Left Behind Act (NCLB) also hinders many types of learners, leaving only a select group of learners unaffected by its constraints. Terry (2010) stated that NCLB shifts the classroom focus towards content-specific learning outcomes and away from learning processes that offer students more choices. She also stated that such choices can help make learning meaningful for students. As American teachers often feel they need to cover many concepts that will be on the test, getting them to diversify lessons in order to accommodate a variety of learners may be problematic. However, according to Lovelace (2005), when teachers do not design lessons that take a variety of learners into consideration, learning is negatively influenced. Lovelace (2005) concluded that a mismatch between students' learning styles and the

teaching style favored by the educational system could be a major factor in the performance of underachieving students.

I am the product of both the Korean and American educational systems. I spent my elementary through high school years in the Korean educational system. Sadly, I was not one of the learners whose learning style was consistent with the teaching style favored by the Korean educational system. Like many of my fellow students in Korea, I struggled through an education system that afforded me very little individualization or adaptability. While student teaching in Hawai'i, I remember my introduction to the realities of the classroom. For one lesson plan, I designed an activity that included visual, verbal, and kinesthetic elements. While reviewing my lesson plan, the classroom teacher complimented my activity as being very engaging, fun, and effective but added that for day-to-day lessons, activities like this were just not feasible. She suggested that I change the activity to a worksheet. Later, I watched a student spend his recess working on the worksheet that I eventually substituted for the activity. I noted to myself that under NCLB, worksheets that can quickly cover multiple concepts, on which students will be tested, will win out over activities that have a narrower focus but better facilitate learning by taking advantage of students' natural learning preferences.

This study investigates a classroom design that allows teaching based on students' natural affinities for learning. I call this type of teaching learning preference congruent teaching. Learning preference congruent teaching seeks to maximize the utility of incorporating practices that take advantage of students' natural affinities for learning into the educational process. The purpose of this study is to investigate a classroom design that can facilitate learning preference congruent teaching in an effective way. Before I discuss the classroom design, I review the

history of learning preferences, variables that influence learning preferences, and how learning preferences have been studied in the following sections.

### **History of Learning Preferences**

A long time before the phrase “learning style” was coined, many philosophers discussed the idea that individuals have different styles of learning. One of the early proponents for the idea that people learn in different ways was the Greek philosopher, Plato (429–347 B.C.E.). Plato mentioned that everyone is different, and individuals construct their knowledge in their own ways (Kolb, 1984). Plato’s pupil, Aristotle, also mentioned that each child has unique abilities and went as far as categorizing personality into four different types.

This discussion continued into the modern age. In 1907, Montessori developed educational materials and tools to accommodate the different learning styles of her students (Goertz, 1997). By the early 1910s, characteristics that affect how children learn were identified, and eventually these characteristics were termed “cognitive styles,” which led to the concept of learning styles (Given & Reid, 1999). Around this time, most of the research on learning styles focused on the relationship between memory and oral/visual methods. Between the 1920s and the 1940s, the study of learning styles declined because it focused too much on students’ cognitive skills and academic achievement (Kolb, 1984). In the 1950s, using the research from the earlier part of the century as a foundation, different learning style models were developed. The following section examines additional background information on variables that influence learning preferences.

### **What Influences Learning Preferences**

Severiens and Dam (1997) investigated the influences of gender, gender identity, age, and field of study on the learning preferences of 432 students at six secondary adult schools in

the Netherlands. The age range of the participants varied from 16 to 71, but most of them were between 16 and 22. Fifty eight percent was female and 42% was male. The authors used the Inventory of Learning Styles (ILS) and the Dutch Sex Role Inventory (NSRV) to define the learning styles and gender identities of the participants, respectively. The participants responded to the questionnaire items within the context of one of the following four subject areas: Dutch (25%), mathematics (29%), biology (21%), or history (25%).

The ILS categorizes learners into four different types of learning styles. Reproduction-directed learners are certificate and vocation oriented, who use stepwise processing strategies and external regulation. Meaning-directed learners are interested in learning that is personally beneficial and tend to utilize deep processing strategies as well as self-regulation. Application-directed learners frequently utilize concrete processing strategies, external regulation, and the knowledge they gain. Undirected learners lack regulation and prefer stimulating education.

The NSRV identifies four different types of gender identities based on the attributes learners use to describe themselves. Androgynous individuals endorse both feminine and masculine attributes. Feminine and masculine individuals select attributes that correspond with their gender identities. Lastly, undifferentiated individuals endorse attributes that are neither feminine nor masculine.

Severiens and Dam (1997) found that when students considered their learning in particular subject areas, those who were categorized as meaning-directed, reproduction-directed, and application-directed learners were influenced by different subject areas. In the subject area of Dutch, there were the most meaning-directed learners, and these learners were found less often in mathematics. The reproduction-directed learners appeared less often in the subject areas of Dutch and history compared to mathematics and biology. The application-directed learners

appeared more often in the subject areas of Dutch and mathematics compared to biology and history.

Severiens and Dam (1997) also found that age was related to learning preferences. Age influenced students with the meaning-directed and undirected learning styles. Older students more often used the meaning-directed learning style. Younger students were more likely to use the undirected learning style.

Furthermore, Severiens and Dam (1997) found that gender identity and gender, to a lesser extent, had some influence on learning preferences. Gender had a significant influence on students with the reproduction-directed and undirected learning styles. Women more often used the reproduction-directed learning style while men more often used the undirected learning style. On the other hand, gender identity had a significant influence on students with the meaning-directed and application-directed learning styles. The androgynous students most often used the meaning-directed learning style while the undifferentiated students used the style less often. The feminine and androgynous students used the application-directed learning style more often compared to the masculine and undifferentiated students.

Alagappan and Ramayan (2007) investigated the influences of ethnicity and gender on the learning styles of 100 undergraduates in a private college in Malaysia. The age range of the participants was 18 to 23, and the ratio of men to women was 1:1. Among the 100 participants, there were 32 Malay, 36 Chinese, and 32 Indian students. The authors used the Barsch Inventory that separates learning styles into three types: visual, auditory, and tactual. Visual learners learn best by seeing images and prefer written rather than verbal instructions. On the other hand, auditory learners prefer verbal rather than written instructions. Tactual learners learn best by engaging in hands-on activities.

Alagappan and Ramayan (2007) found that the predominant learning style of both the Chinese and Indian students was visual, followed by auditory and tactual. On the other hand, half of the Malay students preferred the visual learning style and the other half preferred auditory. The authors also found that the predominant learning style of 77% of the female students was visual, followed by auditory and tactual. On the other hand, about half of the male students preferred the visual learning style and the other half preferred auditory. These results share many common aspects with the results of Sizemore and Schultz (2005)'s study.

Sizemore and Schultz (2005) also found that the female students preferred the visual learning style while half of the male students preferred the visual learning style. However, while half of the male students preferred the visual learning style, it was preferred in concert with the auditory learning style. Additionally, the authors found that all the male students preferred the auditory learning style. Lastly, they found that neither the male nor female students preferred the tactual learning style.

In conclusion, these studies showed that multiple variables influence learning preferences: ethnicity, field of study, age, gender, and gender identity. These variables increase the likelihood people would have certain learning preferences. The following section examines Kolb's framework, which is currently one of the most widely used models in the field of learning preferences (Scott & Koch, 2010).

### **Kolb's Experiential Learning Model**

According to Kolb (1984), the learning process involves up to four cyclic learning modes. See Figure 1 for Kolb's Experiential Learning Model. Each one of the four learning modes is defined by the ability used in it: (a) concrete experience, (b) reflective observation, (c) abstract conceptualization, and (d) active experimentation.

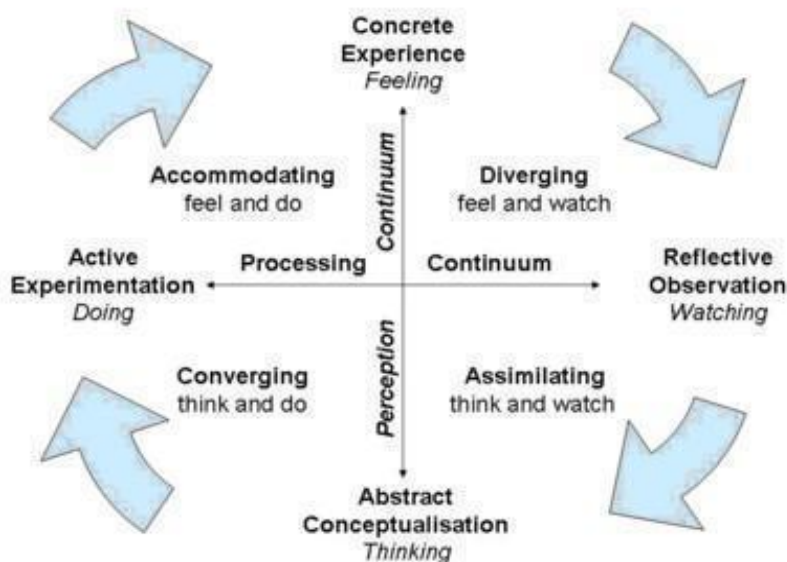


Figure 1. Kolb's Experiential Learning Model presents the four cyclic learning modes and their respective positions on either the processing or perceiving continuum. The model also shows how two learning modes, one from each continuum, are combined to create each of the four learning styles. Adapted from *Experiential Learning: Experience as a Source of Learning and Development* (p. 42), by D. A. Kolb, 1984, Englewood Cliffs, NJ: Prentice-Hall, Copyright 1984 by Prentice-Hall.

The concrete experience learning mode focuses on the ability to be open to new experiences without bias (Kolb, 1984). The reflective observation learning mode focuses on the ability to reflect upon and examine experiences from many perspectives. The abstract conceptualization learning mode focuses on the ability to produce concepts that integrate examined experiences into theories. The active experimentation learning mode focuses on the ability to use these theories when making decisions and solving problems. Ideally, effective learning involves all four of these learning modes.



However, in reality, learning is likely to be specialized and limited by the affinities that learners have for each learning mode (Kolb, 1984). For this reason, Kolb treated his model as a coordinate plane, which is a graph centered around the intersection of an x-axis and y-axis, in order to demonstrate to what extent learners prefer each mode. In Kolb's model, the processing continuum is regarded as the x-axis, and the perception continuum is represented by the y-axis. Kolb used the four learning modes to define the two axes of his plane. The x-axis represents how learners process information. The concrete experience and abstract conceptualization learning modes are the opposite ends of the x-axis. The y-axis represents how learners perceive information, with the active experimentation learning mode and the reflective observation learning mode at each end. Thus, the plane in Kolb's model is split into four quadrants, and each of these quadrants represents a learning style. Kolb's learning styles, which are the quadrants on the plane in his model, are created based on the combination of a perceiving learning mode (either the concrete experience mode or the abstract conceptualization mode) and a processing learning mode (either the active experimentation mode or the reflective observation mode). Just as one uses numbers from each axis to define a point on a plane in mathematics, Kolb uses the learning modes from each axis to define a learning style.

The quadrant a learner falls into indicates his or her dominant learning style, and a learner's position in the quadrant itself determines the extent to which his or her learning style is defined. If a learner's position is closer to the corners of the plane, the learner has a more defined learning style. On the other hand, if a learner's position is closer to the center of the plane, the learner has a less defined learning style. The details of which learning style is made up of which learning modes, and the characteristics of learning modes and learning styles in Kolb's (1984) experiential learning model are explained in Table 1.

Table 1

*The Characteristics of Learning Modes and Learning Styles in Kolb's (1984) Experiential Learning Model*

Learning Style	Learning Modes	
	Processing Learning Mode	Perceiving Learning Mode
<p>Accommodating: AE+CE Action-oriented; enjoy carrying out tasks; good at adapting (themselves) to changing circumstances; solve problems in an intuitive trial and error manner; rely on others for information; and comfortable with people, but sometimes seem impatient and pushy.</p>	<p>Active Experimentation (AE) Focus on doing rather than on observing; emphasize practical application and pragmatic concerns; take some risks; and influence people and environment, and they like to see results.</p>	<p>Concrete Experience (CE) Focus on reality rather than theory; emphasize how they feel; prefer an intuitive and artistic approach to problem solving; function well in unstructured situations; and enjoy relating to people; and prefer to contextualize concepts in terms of personal experience.</p>
<p>Diverging: RO+CE Imaginative and feeling oriented; have interest in people and culture; and prefer cooperative group work and brainstorming.</p>	<p>Reflective Observation (RO) Good at looking at things from different perspectives; appreciate different points of view; emphasize understanding over practical application; and question the meaning of ideas, emphasize reflection over action.</p>	<p>Concrete Experience (CE) Focus on reality rather than theory; emphasize how they feel; prefer an intuitive and artistic approach to problem solving; function well in unstructured situations; and enjoy relating to people; and prefer to contextualize concepts in terms of personal experience.</p>
<p>Assimilating: RO+AC Focus on abstract concepts; more concerned with ideas that are theoretically logical and precise than ideas that have practical use; good at assimilating observations into the construction of theory; and prefer utilizing inductive reasoning.</p>	<p>Reflective Observation (RO) Good at looking at things from different perspectives; appreciate different points of view; emphasize understanding over practical application; and question the meaning of ideas, emphasize reflection over action.</p>	<p>Abstract Conceptualization (AC) Emphasize thinking, ideas, and concepts; prefer a scientific approach to problem solving; focus on building general theories; good at systematic planning and quantitative analysis; and value precision, discipline, and a well-structured system when analyzing ideas.</p>
<p>Converging: AE+AC Focus on the practical application of ideas; good at problem solving and decision making; prefer using deductive reasoning; function well in situations where there is a single correct answer to a question; and prefer dealing with technical and specific problems.</p>	<p>Active Experimentation (AE) Focus on doing rather than on observing; emphasize practical application and pragmatic concerns; take some risks; and influence people and environment, and they like to see results.</p>	<p>Abstract Conceptualization (AC) Emphasize thinking, ideas, and concepts; prefer a scientific approach to problem solving; focus on building general theories; good at systematic planning and quantitative analysis; and value precision, discipline, and a well-structured system when analyzing ideas.</p>

*Note.* Each learning style has unique characteristics (See Column 1) resulting from the combination of a processing and perceiving mode. However, learning styles also include general characteristics, which are derived from the learning modes combined to create them (See Column 2 & 3).

Kolb's (1984) experiential learning model provides a framework for this study. Kolb's model demonstrates how learners can be differentiated along a continuum, and learning preferences exist as specific parts of the continuum. If learning preferences exist, it is worthwhile to investigate teaching that takes into account students' learning preferences. Accounting for learning preferences is at the heart of learning preference congruent teaching. The following section discusses research on the efficacy of learning preference congruent teaching.

## **Literature Review**

### **Literature on Learning Preferences**

**Efficacy of learning preference congruent teaching.** The research on the efficacy of instruction that matches students' learning preferences is mixed. Some research has found that there are no differences in learning outcomes when learning preference congruent teaching is compared to standard teaching (Eudoxie, 2011; Kolloffel, 2011). On the other hand, some research has found that learning preference congruent teaching has positive effects on learning outcomes (Bajraktarevic, Hall, & Fullick, 2011; Exley, 2003; Wang & Liao, 2011). Kolloffel (2011) demonstrated that there was no relationship between learning preference congruent teaching and college students' learning outcomes. Even though information was presented using the visual or verbal format that college students preferred, students' learning outcomes did not improve. The study used two instructional conditions. In one condition, information on combinatorics and probability theory was presented using visual learning materials, such as diagrams, and in the other condition, the same information was presented verbally.

In order to see the effect of presenting information in the format that students preferred on their learning outcomes, Kolloffel (2011) tried to equalize the two learning conditions. To do this, he identified a few possible variables that could affect students' learning outcomes. First,

the instruction provided in the two conditions should be identical. In addition, the learning materials, visual or verbal, should include the same amount of information and require approximately equal amounts of time to be processed. These variables could affect the students' learning outcomes; however, in actuality these variables could be difficult to manage. Teachers may reduce some of these auxiliary variables but not all of them. Therefore, Kolloffel used computer software, which enabled students to learn the same information in either a verbal or visual format. Presumably, by using the software, the researcher could eliminate the possible variables that could affect students' learning outcomes and equalize the two instructional conditions except for the representational format.

According to the American Educational Research Association (AERA) (2006), in order to generalize the findings of a study, its sample should be representative; "sample is similar to the population in all important respects (p.38)." Kolloffel's (2011) study findings do not seem to be generalizable for two reasons: small sample size and convenience sampling. First, compared to the number of variables used in the study, the sample size was too small. Kolloffel used 48 students majoring in psychology or educational sciences. Secondly, the study used convenience sampling in which the participants received class credit for taking part in the study.

Eudoxie (2011) also showed that there were no significant differences in the academic performance of college students with a strong preference for a certain learning style and those without a distinct preference. Even though the results did not show the differences, Eudoxie suggested that learning outcomes may still be enhanced when instructional delivery, assessment, and other factors are modified to take advantage of learning preferences. Eudoxie also suggested that the way learning preferences can affect learning outcomes for students with a preference for a certain learning style and more generalized learners could be examined through the use of

learning preference congruent teaching materials. Eudoxie also suggested that by using learning preference congruent teaching materials, researchers can better investigate the effectiveness of learning preferences on the learning outcomes of students who have distinct learning styles compared to the learning outcomes of students who are more generalized learners.

Other researchers have found that the use of learning preferences can make a difference in learning outcomes. Wang and Liao (2011) demonstrated that learning preference congruent teaching materials improved the learning outcomes of the college students who participated in their study. The study used a treatment group and a control group, and since the two groups' pretest scores were almost the same, only their post-test scores were compared to see whether the participants' learning outcomes improved when instructed using their preferred learning materials. The control group was taught using one type of handout arranged in a standard fixed learning sequence, and the treatment group was taught using four different types of handouts each arranged in a different learning sequence that matched the learning profiles of 23 out of 40 participants in the treatment group. The learning profiles included the following four items: demographic information, learning style, cognitive style, and learning motivation. The study results showed that the treatment group gained significantly higher scores on their post-tests than the control group.

Regretfully, the results in Wang and Liao's (2011) study are questionable because the learning preferences of about half the participants in the treatment group were mismatched with the instructional materials used. The learning preferences of these participants were not reported nor were their scores separated from the participants whose learning preferences matched the instructional materials.

Exley (2003) also showed a positive relationship between learning preference congruent teaching materials and the participants' learning outcomes. He found that five of the seven students, ages seven to eight, with dyslexia preferred visual learning the most and two preferred kinesthetic learning the most, followed by visual learning. The author used learning preference congruent teaching strategies and materials to improve the participants' spelling and computational skills. The author incorporated visual aids, such as big colorful images of words, into his teaching and encouraged the student participants to create their own visual images of the words they were taught. Furthermore, Exley used visual reminders of mathematical terminology. He allowed the kinesthetic learners to solve math problems using their fingers when introducing number bonds from 1 to 20.

All of the seven students in Exley's (2003) study scored higher on their spelling tests after they received instruction with learning preference congruent teaching strategies and materials. Five out of the seven students received higher scores on their later math tests. Even the two students, who did not receive higher scores on their math tests, gained a better understanding of the mathematical concepts covered.

The small sample size used in Exley's (2003) study contributed to both its strengths and weaknesses. Since the sample size was small, it was more feasible for the teachers to provide learning preference congruent lessons; the students were able to receive more individual attention, assistance, and feedback. Moreover, the data collected from each participant could be analyzed thoroughly. Exley did not only show the test scores but also provided the students' answers and computational work on their math tests, which demonstrated that the students were making progress in understanding the concepts covered even if they did not correctly answer the questions.

However, since Exley (2003) used a small sample size, there were many variables other than learning preferences that could affect the results of her study, like the personal attention the students received and the small class size. It seems that these variables were ignored, as Exley did not take them into consideration. Furthermore, the participants' improvement could be due to their enjoyment of the new class structure and the personal attention the study offered. All of the student participants and their parents agreed to participate in the study. The participants were pulled from their general classrooms, during subjects they reported they did not like, for the purpose of participating in the study. This may have created a positive bias toward the study program resulting in increases in the participants' motivation and engagement in class activities as well as their learning outcomes.

Finally, Bajraktarevic, Hall, and Fullick (2011) found a positive correlation between learning preference congruent teaching and learning outcomes. The participants, 22 first year students taking a two-year geography course, scored higher on tests in the session in which they were taught in accordance with their learning preferences in comparison to their scores on tests in the session that was mismatched with their learning preferences. The mean value of scores after the matched session was greater than the mean value of scores after the mismatched session. This study used the same participants in both sessions. By using the same participants, many possible factors that could affect the outcomes, other than learning preferences, were reduced or eliminated.

However, Bajraktarevic, Hall, and Fullick (2011) failed to state the interval of time between the matched session, which was conducted first, and the mismatched session, which was conducted later. If both sessions were tested on the same day, the participants could have been tired in the later session, the mismatched session, thus consequently performed poorly. The

authors also failed to mention the type(s) of test items that were used in the mismatched session. Since the contents of the two sessions were different, each session might have had different levels of complexity in the pre and post-test questions compared to the other session, and this may have resulted in the difference between the two sessions. In conclusion, while the results of the research on the efficacy of learning preference congruent teaching reviewed thus far are mixed, at the very least, they show that learning preference congruent teaching has the potential to positively affect learning outcomes.

**Relationship between the learning preferences of students and teachers.** Students' learning preferences may be related to teachers' learning preferences. Shein and Chiou (2011) showed that the college student participants' learning styles were usually consistent with the learning style of the teacher they selected as their respective role model. In this study, two types of teachers participated, professionals and academic instructors. Professionals were defined as technical teachers by the authors, and these teachers focused on developing practical skills. On the other hand, academic instructors were defined as lecturing teachers, and these teachers focused on explaining the principles and theories underlying practical skills.

Shein and Chiou (2011) used the Learning Style Inventory (LSI) to assess the dominant learning modes of both the teachers and the students. The LSI is based on Kolb's (1984) experiential learning model. See Table 1 on p. 9 for the characteristics of Kolb's learning modes and learning styles. The students who identified the technical teachers as their role models, as opposed to the lecturing teachers, received higher scores on the concrete experience and active experimentation modes, which create the accommodating learning style. The participants who identified the lecturing teachers as their role models, as opposed to the technical teachers, scored higher on the abstract conceptualization and reflective observation modes, which create the



assimilating learning style. The teachers had dominant modes similar to those of the students who selected them as their role models. Moreover, the authors found that while the college students were under the tutelage of a teacher with whom they shared a learning style, the learning preferences of the students became more pronounced.

**Organization of learning preference congruent materials.** Hoffler, Prechtel, and Nerdel (2010) stated that when taking advantage of learning preferences in education, it is not only important that learning materials are congruent with learners' preferred styles of learning, e.g., visual materials for visual learners, but the format and structure of the materials are also important. These researchers used two instructional conditions. In one condition, information was presented through 16 static pictures and text. In the other condition, the same information was presented using animated images and the same text as the static pictures. The participants in both conditions were pre-tested on the information that was to be presented. Since there was a significant difference between the pre-test scores of the two conditions, the differences in the pre-test and post-test scores of each condition were compared rather than their post-test scores alone. Both conditions included participants who were highly developed visualizers and those who were less developed visualizers. There was only a significant difference in the increase of the pre and post-test scores for highly developed visualizers when the information was presented in a static visual format, but not in an animated format, even though it was still visual.

Wang and Liao (2011) also highlighted the importance of the structure of learning preference congruent materials, specifically sequence. They showed that when the sequence of teaching materials was congruent with the learning preferences of college students, their learning outcomes improved.

The importance of format and structure of learning preference congruent materials may help explain the results from Kolloffel's (2011) study, described earlier. Kolloffel did not find any differences between the learning outcomes of students who were taught using materials congruent with their learning preferences and the learning outcomes of students who were taught using materials that were not congruent with their learning preferences.

However, in the light of both Wang and Liao's (2011) study and Hoffler, Prechtel, and Nerdel's study (2010), affecting learning outcomes may not be as simple as making teaching materials or teaching techniques congruent with the learning preferences of students, but may also include the sequence and format of learning preference congruent materials. If Kolloffel conducted his study using learning preference congruent materials presented in several different formats and sequences, the results may have been different.

**Shared characteristics of research participants.** Except for one study, which involved elementary students with dyslexia, all of the studies reviewed, and most learning preference studies in general, used college students as participants. The college students who participated in each of the reviewed studies shared certain characteristics, such as major, age, and ethnicity. The homogeneity of the participants of the studies may have had an effect on learning preferences. For example, in Shein, and Chiou (2011), more than two thirds of the hospitality undergraduates selected their technical teachers over their lecturing teachers as their role models, and they had concrete rather than abstract learning styles, and active rather than reflective learning styles. This was in accordance with data from Lashley and Barron (2006) who also found that hospitality and tourism students typically preferred concrete and active learning environments.

Eudoxie (2011) found that there was a predominant learning style among the participants who were either agriculture majors or environmental and natural resource management majors.

The study used the Index of Learning Styles (ILS) and Visual, Auditory, Read/Write, and Kinesthetic (VARK) instruments. The ILS instrument was used to discern the learning styles of the participants, and the VARK instrument was used to gauge their basic sensory learning preferences. The data gathered from the ILS showed that most participants were active, sensing, visual, and sequential learners. Active learners prefer learning by doing. Sequential learners prefer learning in a linear step-by-step fashion. Visual learners process information best when it is presented through images or in formats that can be seen. Sensing learners are very practical and detail oriented learners. The data gathered from VARK demonstrated that half of the participants were kinesthetic. Kinesthetic learners learn best by touching and doing. The results for the other half of the participants were a mix of the remaining categories (visual, auditory, and read/write); visual learners learn best by seeing, auditory learners learn best by hearing and speaking, and read/write learners learn best by reading and writing.

Scott and Koch (2010) used two instruments, the Kirton Adaption-Innovation Inventory (KAI) and the LSI, to gather data on 33 technology students in the Industrial Engineering Department. The KAI was used to determine the problem-solving approach of the participants, and the LSI was used to assess the participants' learning preferences. The data obtained using the KAI did not show a dominant problem solving approach among the participants. Half of the students were characterized as relatively adaptive, and the other half was characterized as relatively innovative. Adaptors generally have the characteristics of providing balance, valuing group cohesion, and being methodical and detail oriented. On the other hand, innovators commonly have the characteristics of providing dynamics for radical change, thinking in risky and unexpected ways, and preferring overview rather than detail.

The responses on the LSI revealed that 54% of the participants were “combination” learners, and the remaining participants were divided among the standard four categories, diverging (11%), assimilating (11%), converging (7%), and accommodating (17%). The study clearly defined the types of learning modes that were combined to create four different types of learning preferences (accommodating, diverging, converging, and assimilating). However, the authors failed to define what combination of modes or learning styles were combined to create the “combination” category, which characterized most of the participants.

Cheng, Andrade, and Yan (2011) found that the national origins of students could influence their thinking styles, which the authors argued were related to their learning styles. They used the Style of Learning and Thinking questionnaire that separates thinking into three modes: holistic, analytical, and integrative. Holistic thinkers do not tear things apart mentally to understand them, and they tend to approach a subject by trying to understand its general meaning. On the other hand, analytic thinkers are inclined to understand the parts of a concept before considering the whole concept. Integrative thinkers have both analytic and holistic characteristics. The researchers found that both Chinese students in China and the USA preferred the holistic and integrative thinking styles. Moreover, there was no significant difference between Chinese students in the USA and China for the holistic and integrative thinking styles. American students, on the other hand, demonstrated a preference towards the analytic thinking style.

**Effective teaching strategies for different types of learners.** Most of the articles reviewed indicated that learning preference congruent instruction and materials helped learners improve their understanding of the concepts being taught (Exley, 2003; Hoffler, Prechtel, & Nerdel, 2010). Even the authors (Eudoxie, 2011; Scott & Koch, 2001), whose studies did not

show results supporting the efficacy of learning preferences, qualified their results in support of learning preferences.

Eudoxie (2011) did not show a difference in the learning outcomes of students with a strong learning preference compared to others with a less pronounced preference. Eudoxi stated that if his study had incorporated teaching strategies specifically designed to accommodate an array of learners, he thought the study results would have changed. Furthermore, he suggested that learning outcomes may be enhanced when instructional delivery, assessment, and other factors are modified to take advantage of learning preferences.

Scott and Koch (2010) found that most of the technology students enrolled in the Industrial and Engineering Department they studied were multi-modal, which indicated the students did not have a dominant learning preference. However, the authors suggested that the lack of a dominant preference among a certain group of people did not lessen the importance of learning preferences. Furthermore, they suggested that learning preferences may be more important when designing the curriculum for students in certain fields of study, like technology, who are usually multi-modal or have diverse learning preferences. To this point, Scott and Koch stated that the most effective teaching methods for university level technology students are to expose the students to various preferences and problem solving approaches.

**Reflections on learning preference research.** After reviewing the articles on learning preferences, I found that learning preference congruent teaching has the potential to improve learning outcomes. Eight of the eleven articles reviewed demonstrated that there was some type of positive relationship between learning preference congruent teaching and learning outcomes.

However, I found two overarching limitations regarding learning preference congruent teaching. The first limitation is practicality. Most classrooms have students with different

learning preferences; however, the participants in each of the reviewed studies were generally homogeneous. Except for one study, the participants in all the studies reviewed had similar characteristics, such as major or ethnicity, thus their learning preferences were very similar or the same. Since the participants had the same or similar learning preferences, their learning preferences could be easily accommodated using limited teaching strategies and materials. However, in most classrooms where students with different learning preferences study together, more types of teaching strategies and materials are required to accommodate the wider range of learning preferences.

The first issue of practicality is related to time constraints teachers face in the classroom. If teachers attempt to accommodate all the possible types of learners in their classes, they may need to use several activities since one activity usually accommodates only specific types of learners. There is often not enough class time for teachers to conduct multiple learning preference congruent activities on the same concept, especially if these activities are conducted one at a time for the whole group as typical classroom practice.

The second limitation of learning preference congruent teaching was noted by Eudoxie (2011) and Hoffler et al. (2010). These researchers, regardless of their study results, agreed that using students' preferred learning methods increases student learning outcomes. However, they noted that there are some limited circumstances in which using students' preferred learning methods is not the most effective way to increase student learning outcomes. I define this as the limitation of diversification in instructional strategies. Because of this limitation, there is a need for diverse instructional strategies in learning preference congruent teaching, more specifically, a need to provide an optimal balance between learning preference congruent and non-congruent instructional strategies.

In addition, Eudoxie (2011) and Hoffler et al. (2010) stated that the most effective teaching method for students varies based on the context of the lesson, which includes the subject matter or specific topics being taught. For example, the most effective teaching method for students to understand concepts in social studies and math may be different. Even in the same subject, depending on the topics being taught, effective teaching methods for students may be different. To sum up, lessons that accommodate students' learning preferences usually help students understand concepts and increase their learning outcomes (Hoffler et al., 2010), but providing diverse instructional strategies is necessary when lessons that are not consistent with learning preferences become a more effective way to help students understand concepts and increase their learning outcomes.

In order to take advantage of the potential of learning preference congruent teaching while working around its limitations, a classroom design must mitigate the limitations of practicality and diversification in instructional strategies. In order to mitigate the limitation of practicality regarding the time constraints of teachers, a classroom design must use class time in a way that accommodates multiple learning preferences simultaneously. Secondly, concerning the limitation of diversification in instructional strategies, a classroom design must provide learners with the opportunity to interact with class activities that accommodate not only their own preferred learning styles, but also other learning styles.

The classroom design outlined in the Center for Research on Education, Diversity, and Excellence (CREDE) model may meet these criteria. The following section reviews literature on CREDE. In that section, I first explain the mission of CREDE and the CREDE Five Standards. Afterwards, I explain the CREDE model and the activity centers used in the model. Lastly, I

discuss student learning outcomes and student engagement levels associated with the CREDE model.

### **Literature on CREDE**

**The Center for Research on Education, Diversity, and Excellence (CREDE).** The Center for Research on Education, Diversity, and Excellence (CREDE) was a national research and development center at the University of California (Yamauchi, Wyatt, & Carroll, 2005). CREDE focused on maximizing the educational potential of students, especially students from non-majority language or cultural backgrounds, by providing educators with an effective and practical pedagogy. This pedagogy is not limited to a certain curriculum or a specific grade level, and it can be applied in any content area and to any grade level. The Standards are based on Vygotsky's (1978) sociocultural theory. According to CREDE researchers, effective learning takes place when teachers utilize pedagogy that embodies the CREDE Five Standards (Doherty & Hilberg, 2007; Estrada 2005; Hilberg et al., 2003; Saunders & Goldenberg, 2007; Tharp, Estrada, Dalton, & Yamauchi, 2000; Yamauchi et al., 2005). Below, I describe each Standard.

***Standard 1: Joint Productive Activity.*** According to CREDE researchers, effective learning takes place when teachers and students engage in activities for the purpose of creating products together (Doherty & Hilberg, 2007; Estrada 2005; Hilberg et al., 2003; Tharp et al., 2000; Yamauchi et al., 2005). Tangible products can be essays, artifacts, and research reports (Hilberg et al., 2003; Yamauchi et al., 2005). Intangible products can be conceptual understandings and changes in thoughts as well as behaviors, which are inspired by class discussions or activities.



***Standard 2: Language and Literacy Development.*** Acquiring language competency and literacy skills are essential for school success; therefore, these fundamental skills should be focused on across the entire curriculum (Hilberg et al., 2003; Yamauchi et al., 2005). Effective learning takes place when teachers provide students with activities in which students are encouraged to use oral and written language, especially academic terms (Doherty & Hilberg, 2007; Estrada 2005; Hilberg et al., 2003; Tharp et al., 2000; Yamauchi et al., 2005).

***Standard 3: Contextualization.*** Effective learning takes place when teachers link new information to students' prior knowledge and experiences (Doherty & Hilberg, 2007; Estrada 2005; Hilberg et al., 2003; Tharp et al., 2000; Yamauchi et al., 2005). This can be achieved incidentally or intentionally. Incidental contextualization is teachers' unplanned comments and questions to students that happen to correspond with the past experiences of their students. Conversely, intentional contextualization occurs when teachers design activities that provide students with opportunities to apply the concepts they are learning to their prior experiences at home, in their community, and at school (Yamauchi et al., 2005). When new information is contextualized, students are more motivated, and they have higher retention rates, resulting in deeper understanding (Doherty & Hilberg, 2007; Estrada 2005; Hilberg et al., 2003; Yamauchi et al., 2005).

***Standard 4: Complex Thinking.*** Effective learning takes place when teachers promote students' engagement in higher-level thinking (Doherty & Hilberg, 2007; Estrada 2005; Hilberg et al., 2003; Tharp et al., 2000; Yamauchi et al., 2005). This can be achieved when teachers encourage students to consider "why" questions in addition to "who, what, when, and how," questions. Effective learning also takes place when teachers use activities that require complex thinking skills, such as synthesizing and analyzing, and when teachers assist students in

connecting concepts taught in lessons to more abstract concepts (Doherty & Hilberg, 2007; Estrada 2005; Hilberg et al., 2003; Tharp et al., 2000; Yamauchi et al., 2005).

***Standard 5: Instructional Conversation (IC).*** Effective learning takes place when teachers have small group discussions with students to guide them in acquiring specific learning goals (Doherty & Hilberg, 2007; Estrada 2005; Hilberg et al., 2003; Saunders & Goldenberg, 2007; Tharp et al., 2000; Yamauchi et al., 2005). Learning goals are set in order to assist students in understanding concepts that they cannot understand by themselves. IC enacted at the highest level is characterized by students speaking at a higher rate than the teacher, and the teacher assessing the students' levels of understanding and assisting in developing their conceptual understandings.

**CREDE activity centers.** The CREDE model has many facets (Hilberg et al., 2003). However, one of the most prominent features of a CREDE classroom is its activity centers. A CREDE classroom is organized into several activity centers, and each center is focused on a different center task (Doherty & Hilberg, 2007; Hilberg et al., 2003). These center tasks are the focus of this study. Even though the tasks at each center vary, they are all connected to the theme of the day's lesson. The types and complexity of the tasks vary. Three to seven students typically work on the learning task at each center, and at scheduled intervals, students switch centers. Eventually students rotate through all the centers and complete all the required tasks, working with different peers at each center.

There are two types of CREDE activity centers: teacher-led centers and independent centers led by students (Hilberg et al., 2003; Yamauchi et al., 2005). A CREDE classroom generally has one teacher-led activity center at which a teacher works with a small group of students on a challenging task. At the independent centers, students typically follow directions

written on task cards. The students at the student-led centers are often organized into heterogeneous groups, in the sense that they include students of different cognitive and achievement levels (Hilberg et al., 2003). On the other hand, the students at the teacher-led center are often organized into more homogeneous groups, so that the teacher can differentiate instruction based on the needs of the students.

Like small group activities in typical classrooms, all students are expected to participate in CREDE activity centers (Doherty & Hilberg, 2007; Hilberg et al., 2003). However, unlike other small group activities, in CREDE activity centers, the role of teachers is critical. Teachers do not just plan and supervise the activity centers, but in a CREDE classroom, teachers actively participate in the teacher-led activity centers. Using their expertise, teachers provide students with responsive feedback by asking questions, assessing the level of students' understanding, and alternating the forms of assistance they use (Doherty & Hilberg, 2007; Hilberg et al., 2003; Saunders & Goldenberg, 2007; Yamauchi et al., 2005).

The activity centers are designed as a way to implement the CREDE Five Standards. The Standards are embedded in the centers (Hilberg et al., 2003). At each activity center, group members typically work together in a joint productive activity to create either tangible or intangible products. All the centers are designed to encourage students to use language. While creating products, students at the activity centers are communicating with their peers and the teacher. The goal of the teacher-led center is to conduct an Instructional Conversation that contextualizes instruction in students' past experiences and promotes complex thinking. Ideally, not only the teacher-led center, but also the student-led centers incorporate the CREDE Standards, except for the fifth standard, Instructional Conversation, which is only possible at the teacher-led center.

**CREDE, student achievement, and engagement.** The literature reviewed supported a positive relationship between the use of the CREDE model and increases in learning outcomes (Doherty & Hilberg, 2007; Estrada, 2005; Hilberg, Tharp, & DeGeest, 2000; Saunders & Goldenberg, 2007; Yamauchi et al., 2005). The studies reviewed also demonstrated the adaptability of the CREDE model for different age groups, as the model has been successfully used in preschool, elementary school, middle school, and high school. For example, Yamauchi et al. (2005) described a positive relationship between students' learning outcomes and the use of the CREDE model in a high school setting. The authors described increases in the learning outcomes of students in Grades 10 to 12 in the Hawaiian Studies Program at Waianae high school, which CREDE adopted as a demonstration school for enacting the Five Standards. The authors also described that since the students enrolled in the program, they maintained good attendance, were less likely to drop out of school, and were more likely to pursue post-secondary education.

In addition, Hilberg, Tharp, and DeGeest (2000) studied the relationship between the CREDE method of instruction and students' learning outcomes in mathematics as well as their attitudes toward mathematics. The study included 31 American Indian middle school students. The researchers found that students, who were taught using the CREDE pedagogy, had greater achievement and retention than those who received traditional instruction. The study also found that CREDE instruction was related to a greater increase in students' positive attitudes toward mathematics.

Furthermore, Doherty and Hilberg (2007) studied the relationship between the CREDE pedagogy, classroom organization, and learning outcomes in an elementary school setting. The study was conducted at two California elementary schools serving predominantly low income

Latino English language learners. The authors compared the standardized test scores of four groups of students in Grades 3 to 5. Each group was taught in one of four learning environments, which were made up of different combinations of two variables: classroom organization (whole-class instruction or activity center groups) and the degree to which teachers implemented the CREDE Five Standards (high or low). The study results showed that the group in which the teachers organized their classrooms into activity centers and incorporated the CREDE Five Standards into their teaching to a high degree demonstrated greater achievement on the standardized test.

Saunders and Goldenberg (2007) also conducted a study with elementary students. They specifically examined the way Instructional Conversation (IC) affected how students understood complex concepts and their literal comprehension of class readings. IC is one of the essential components in the teacher-led activity center in a CREDE classroom. The study was conducted in the fourth-grade classroom where Mrs. Fiske, a participant in the IC project, taught students who were typically in their first year of transition from Spanish to English instruction. Among the 27 students who participated in the study, 23 students were transitioning students.

Around the time Saunders and Goldenberg (2007)'s study was conducted, Mrs. Fiske was finishing a month-long unit on a storybook. One of the most important concepts discussed in this unit was friendship, but Mrs. Fiske observed that her students generally did not grasp the differentiated and complex conception of friendship that the unit attempted to convey. Therefore, the authors and Mrs. Fiske decided to include an additional short story in the unit in order to assist the students in developing a complex and differentiated view of friendship. Half of Mrs. Fiske's students participated in an IC lesson, and these students served as the experimental group. The other half of her students participated in a recitation lesson, and these students served as the

control group for the study. The study divided the students between the control and experimental groups in a way that ensured the two groups had comparable test scores on the Spanish Assessment of Basic Skills.

Saunders and Goldenberg (2007) also used a pre-test and a post-test. The results of the pretest, which was comprised of a prompted essay, showed that the majority of the students did not have a complex or differentiated conception of friendship. The control group spent a majority of the lesson reviewing and rehearsing the literal details of the story while the IC group spent about half of the lesson reviewing and discussing the concept of friendship and the other half of the lesson applying the concept to the story. A post-test was administered to both groups after their respective lesson, an essay with the same prompt as the pretest, and a set of 10 comprehension questions. The results of the post-test demonstrated that the majority of the students who had the IC lesson understood the differentiated and complex conception of friendship, which was presented in the unit. On the other hand, very few students in the control group showed this understanding. Furthermore, the IC students' scores on the 10 comprehension questions included in the post-test were the same as or higher than the scores of the students in the control group. In addition, the researchers found that compared to the students in the control group, the IC students had more opportunities to talk. On average, the IC students' turns to talk were as long as the teacher's. However, the students' turns to talk in the control group, were on average much shorter than the teacher's.

Lastly, Estrada (2005) showed that increases in student achievement in reading co-occurred with increases in the use of the CREDE Five Standards by teachers in an elementary setting. Estrada found that students taught by teachers who fully implemented the CREDE Five Standards in small-group reading instruction had much higher achievement in reading than

students taught by teachers who did not. Seventy-one percent of the students taught by teachers who fully implemented the Five Standards met their grade level requirement for reading, while only 44% of the students taught by teachers who fell short of full implementation met their grade level reading requirement.

Overall, the reviewed literature suggested that the use of the CREDE model increased students' learning outcomes and engagement. The studies reviewed also demonstrated the adaptability of the CREDE model for different age groups.

### **Summary of Literature and Research Questions**

After reviewing the learning preference literature, two limitations were found. These limitations would have to be mitigated by a classroom design that effectively facilitates learning preference congruent teaching. The first limitation was practicality. Since a typical activity usually accommodates only certain types of learners, a teacher has to use several activities in order to accommodate a variety of learning preferences. This is not a practical use of teaching time. The second limitation was the lack of diverse instructional strategies. By acknowledging this limitation, one admits that there are some instances when accommodating students' learning preferences is not the most effective way to increase students' understanding and learning outcomes.

Based on the literature reviewed (Doherty & Hilberg, 2007; Hilberg et al., 2003), I concluded that the classroom design outlined in the CREDE model may address the two limitations regarding learning preference congruent teaching. A CREDE-based classroom could make learning preference congruent teaching more practical by accommodating multiple learning preferences at the same time. This is possible because in a CREDE classroom, there are multiple activity centers, at which different center tasks are simultaneously conducted (Doherty

& Hilberg, 2007; Hilberg et al., 2003). If the simultaneously conducted tasks accommodate a variety of learning preferences, the model would make learning preference congruent teaching feasible within the time constraints of an average class session.

Furthermore, a CREDE classroom could mitigate the second limitation of learning preference congruent teaching by exposing students to a diverse range of instructional strategies. A CREDE classroom does this by requiring students to rotate through all the classroom's activity centers and complete each center's task (Doherty & Hilberg, 2007; Hilberg et al., 2003). These rotations offer many opportunities for students to complete a variety of tasks (Doherty & Hilberg, 2007; Hilberg et al., 2003), and if each of these tasks covers all the major course concepts in ways that accommodate the full spectrum of learning styles, all four of Kolb's (1984) learners, then the model would mitigate the second limitation, which is the lack of diversification in instructional strategies, by providing the diversification necessary to attain an optimal balance between learning preference congruent and non-congruent instructional strategies.

Providing a diverse range of instructional strategies is important when lessons that are not consistent with learning preferences become a more effective way to help students understand concepts and increase their learning outcomes. The following example highlights how the CREDE model could address the limitation of diversification in instructional strategies. A student, who prefers learning through abstract conceptualization, may learn a certain concept better through an activity based on concrete experience. If an activity center that included a task based on concrete experience were present in a CREDE classroom, all the students would rotate through that center and complete the task regardless of their learning preferences. Thus, the structure of a CREDE classroom has the potential to provide the diversification necessary to



attain an optimal balance between learning preference congruent and non-congruent instructional strategies.

In conclusion, the CREDE model may facilitate learning preference congruent teaching while substantially mitigating the two limitations associated with learning preference congruent teaching: practicality and diversification in instructional strategies. Moreover, aspects of the CREDE model may intrinsically facilitate learning preference congruent teaching. Therefore, these aspects of the CREDE model deserve to be explored, so that they may be added to CREDE's many other merits.

There are some studies that investigated the relationship between the CREDE model and students' learning outcomes as well as their engagement; however, none of the articles reviewed explored the relationship between the CREDE model and students' learning preferences. Consequently, no studies examined how this relationship enriches the CREDE model, in terms of students' perceptions of the helpfulness, engagement, and enjoyment of CREDE center tasks. Thus, this study investigates how well the CREDE model facilitates learning preference congruent teaching. The research questions were: How effectively do CREDE activity center tasks accommodate students with different learning preferences? How is the learning preference congruence of center tasks related to students' perceptions of their levels of engagement in center tasks, their enjoyment of center tasks, and the extent to which center tasks are helpful in understanding class concepts?

I anticipated that different activity center tasks used in the CREDE model would appeal to students with different types of learning styles and allow the model to accommodate a broad array of learning preferences. I also anticipated that there would be a positive relationship between the center tasks that accommodated students' learning styles and the center tasks that

they perceived as more engaging, helpful, and enjoyable. Overall, I anticipated that the CREDE model would facilitate learning preference congruent teaching while substantially mitigating the two limitations regarding learning preference congruent teaching.

It is important to note that the relationship between learning preference congruent teaching and student learning outcomes was not investigated in this study. The scope of this study was limited to investigating the CREDE model's innate ability to accommodate students with different learning preferences and mitigate the two limitations of learning preference congruent teaching. Since no studies supported that the CREDE model effectively facilitates learning preference congruent teaching, it was necessary for this study to establish the CREDE model's ability in this respect. Therefore, how learning preference congruent teaching could be used in concert with the CREDE model to increase student learning outcomes was beyond the scope of this study.

### **Method**

This study was a case study of how undergraduates with different learning preferences perceived the various activity center tasks of a CREDE-based classroom.

#### **Participants and Setting**

The participants in this study were 16 undergraduates at the University of Hawaii (UH) who enrolled in EDEP 201: Introduction to Teaching in fall 2012. EDEP 201 was a biweekly CREDE-based, writing intensive course. All 16 students in EDEP 201 consented to participate in this study. The students signed a consent form that covered information about the purpose, the participant commitments, and the procedures of this study. Before having the students sign the consent form, I explained that their grades would not be affected by their participation.

Among the 16 participants, there were 10 different majors represented (psychology, family resources, secondary language studies, math, elementary education, secondary education, art, English, medical technology, and social work). Two participants had not yet decided on a major. The participants cited one or both of the following reasons for enrolling in the course. They had to complete a certain amount of writing intensive courses or they were thinking of becoming teachers.

All the participants spoke English as their first language, and most of them were either Japanese-American (n=5) or European-American (n=5). The remaining six students varied in ethnicity: African-American, European-Japanese mixed, Filipino-American, Filipino-Hawaiian mixed, Hawaiian, and Korean-American. Except for two participants, the average age of the participants was 20. Among the two exceptions, one was in her late 20s, and the other participant was middle aged.

I selected EDEP 201 for several reasons. First of all, EDEP 201 was a CREDE-based classroom, and the instructor of the class allowed me to use her class for this study. In the semester before I conducted this study, I took another CREDE course taught by the same instructor of EDEP 201. I was fascinated by how the instructor ran the class using a variety of CREDE activities. Based on my experience in her CREDE class and the literature reviewed, I concluded that the CREDE classroom design may accommodate students with different learning preferences, while substantially mitigating the two limitations of practicality and diversification in instructional strategies.

Another reason why I chose EDEP 201 for my study was that compared to the other CREDE-based courses taught by the instructor of EDEP 201, the students of EDEP 201 came from a diverse range of majors. Therefore, I expected that the class would have a variety of

learning styles, as many learning preference related studies have shown that there is a relationship between major and learning preference (Lashley & Barron, 2006; Shein & Chiou, 2011). This diversity facilitated investigating how well the CREDE classroom would accommodate students with different learning preferences.

**The structure of EDEP 201, the CREDE classroom.** The structure of EDEP 201 included the general characteristics of a CREDE classroom. In EDEP 201, there was always one teacher-led center and two or three student-led centers. At the student-led centers, the students worked on their assigned center tasks, which were designed to help them understand class concepts without the instructor's assistance (L. Yamauchi, personal communication, September 10, 2012). At the teacher-led center, the instructor engaged the students in an instructional conversation through which she assisted the students in understanding and interpreting complicated concepts.

At these activity centers, small groups of four to six students worked together to complete center tasks. The center tasks were designed by the instructor of EDEP 201 to help the students understand the day's or week's concepts (L. Yamauchi, personal communication, September 10, 2012).

**The major concepts taught in EDEP 201.** The major course concepts taught in EDEP 201 were the CREDE Five Standards, its corresponding rubric, Korthagen's (2004) Onion Model and core qualities. Center tasks covering these course concepts were conducted at both the teacher-led and student-led activity centers. Lessons on the CREDE Standards covered the CREDE Five Standards and the use of the corresponding rubric called the Classroom Observation Rubric (COR) (Luning, Wyatt, & Im, 2011). See Appendix A for the COR. Lessons

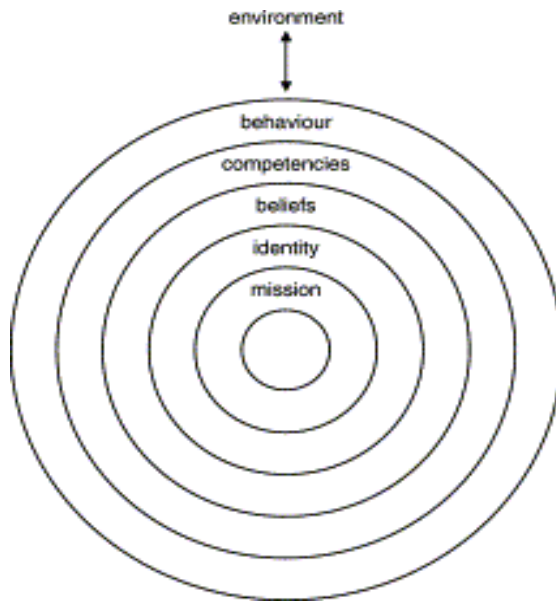
on Korthagen's Onion Model covered the different levels of the onion model with special attention on the innermost level, core qualities.

***The CREDE Five Standards and the COR.*** The details of the CREDE Five Standards were previously discussed on p. 23. The COR is used to rate to what extent the Five Standards are used in the classroom. On the COR, each CREDE standard is scored from 0 (not observed) to 5 (exemplary). The criterion for each score is described in the COR.

***Korthagen's Onion Model and core qualities.*** Korthagen's (2004) Onion Model consists of seven levels: environment, behavior, competences, beliefs, identity, mission, and core qualities. Each level represents a conceptual place from which teachers function and at which teachers can be influenced. These levels are interrelated and influence one another. For example, if a teacher believes that students learn best by helping their peers, the teacher may prefer to use group work. See Figure 2 for a visual representation of Korthagen's Onion Model.

According to Korthagen (2004), the outermost level of the model represents environment, such as society, class, students, and school. Moving inward, the next level represents the behavior of teachers. Only the two most superficial levels are outwardly observable. The first level that is not outwardly observable is competencies. This level includes teachers' knowledge, skills, and attitudes. Teachers' competencies are based on their beliefs, which constitute the level underlying competencies. Proceeding deeper, the next level is professional identity, which represents how teachers define themselves as educators. The second innermost level is mission, which denotes what teachers see as their calling in the world. Core qualities, the last and innermost level, represent teachers' inner strengths, such as empathy and creativity. Compared to competencies that are from the outside, core qualities come from the inside. Core qualities can be categorized into the following three groups: thinking, feeling, and action. In general, it is the

outer levels of the model that affect the inner levels. However, it is also possible for the inner levels to affect the outer levels.



*Figure 2.* Korthagen's (2004) Onion Model consists of seven levels: environment, behavior, competences, beliefs, identity, mission, and core qualities. Each level represents a conceptual place from which teachers function and at which teachers can be influenced. Adapted from "In Search of the Essence of a Good Teacher: Towards a More Holistic Approach in Teacher Education," by F. A. J. Korthagen, 2004, *Teaching and Teacher Education*, 20, p. 80. Copyright 2003 by Elsevier Ltd.

**The center tasks of EDEP 201.** I categorized the EDEP 201 center tasks into the following six types: (a) Final Word, (b) discussion paper, (c) drawing, (d) CREDE application, (e) core quality application, and (f) brainstorming. With the exception of the drawing and brainstorming tasks, all tasks were conducted on a regular basis in EDEP 201. The instructor confirmed these six different types of center tasks (L. Yamauchi, personal communication, September 10, 2012).

The Final Word task was conducted after the class finished certain chapters of the assigned readings. Most of the time, this task was conducted at the teacher-led center. During the Final Word task, each student selected a quote from the assigned reading and read it to his or her group members. Then, each of the group members commented on the quote. Lastly, after hearing these comments, the student who chose the quote explained why he or she had chosen the quote.

The discussion paper task was a weekly feature of EDEP 201, and it was mostly conducted at the student-led centers. When a new concept or a learned concept in a new context was introduced in class, the students first read about the concept in their assigned reading and wrote a discussion paper on it, using a prompt from the instructor. The prompts for the discussion papers were always related to the concepts covered in class. The following is one of the prompts provided: “What kinds of core qualities are reflected in the school leaders portrayed in this chapter? Provide examples.” During the discussion paper task, the students read and then wrote comments on each of their group members’ papers, after which they discussed the papers as a group.

There were two types of tasks that involved practical application: the CREDE application task and the core quality application task. These tasks were split evenly between the teacher-led centers and the student centers. These tasks required the students to apply learned concepts to actual situations. In the CREDE application task, the students used the COR (Luning et al., 2011) to rate the lessons of teachers they observed in videos or read about in the course readings. They also used the COR to rate the lessons taught by their classmates and the EDEP 201 course. In the core quality application task, the students identified the core qualities of teachers in various contexts.

The drawing task was a one-time task and conducted at a student-led center. During the drawing task, the students demonstrated their understanding of learned concepts through drawing. In this task, the students drew core qualities represented by one or more of the teachers they read about in their assigned readings. The drawing task required imagination and had to be completed using an artistic problem solving approach.

The brainstorming task required the students to come up with as many core qualities as possible and categorize them into the following three groups: thinking, feeling, and action. The brainstorming task was similar to the core quality application task, but the brainstorming task asked the student to list core qualities in the abstract, without a specific context or example as a point of reference. The brainstorming task was designed to be a student-led task, but later the task was converted to a teacher-led task in response to student difficulties (L. Yamauchi, personal communication, September 13, 2012). In the follow-up brainstorming task, at the teacher-led center, the instructor asked the students to discuss people they admired in order to come up with core qualities. Then, the instructor guided the students in categorizing the identified core qualities.

### **Data Sources**

This study used five different types of data sources. First, the LSI was used to discern the learning preferences of the participants. Secondly, the learning profiles were used to evaluate whether or not the participants' reasons for preferring or disliking certain center tasks were consistent with the characteristics of Kolb's (1984) learning styles and learning modes. The third data source was my observations of EDEP 201, which were recorded in field notes and a research journal. The fourth and fifth data sources were semi-structured individual interviews and semi-structured focus group interviews. Below, I describe each data source in more detail.



**The Learning Style Inventory (LSI).** During the second week of class, all 16 students in EDEP 201 completed the LSI. The LSI was used to discern the learning preferences of the participants. See Appendix B for the LSI.

Kolb (1984) who is an American educational theorist created the LSI and the Experiential Learning Model, on which the LSI is based. The LSI is one of the most commonly used instruments in the learning preference articles reviewed (Scott & Koch, 2010; Shein & Chiou, 2011; Wang & Liao, 2011).

The LSI is comprised of twelve sentences; each sentence has four possible endings (Patsidou & Metallidou, 2009). The four possible sentence endings are ranked from 4 (most favorable) to 1 (least favorable). Each ending represents one of the four learning modes defined by Kolb (1984). See Table 1 on p. 9 for the characteristics of Kolb's learning modes and learning styles.

The participants' LSI results were plotted on the LSI grid, which was a version of the plane in Kolb's (1984) model used for graphing the LSI results. See Figure 3 for the LSI grid. Like the plane in Kolb's model, the LSI grid is split into four quadrants by the processing and perceiving continua, which are the x and y axes of the grid. The quadrant a participant fell into indicated his or her dominant learning style, and a participant's position in the quadrant itself determined the extent to which his or her learning style was defined. If a participant's position was closer to the corners of the grid, the participant had a more defined learning style. On the other hand, if a participant's position was closer to the center of the grid, the participant had a less defined learning style.

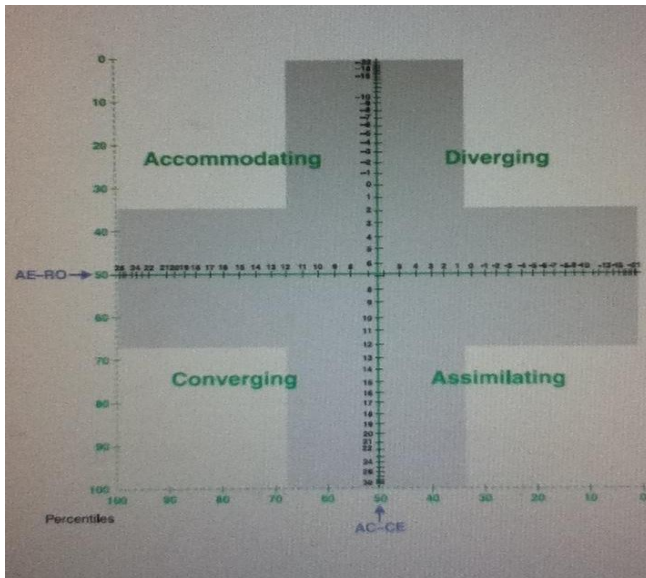


Figure 3. The Learning Style Inventory grid is a version of the plane in Kolb's (1984) model used for graphing the LSI results. The LSI grid is split into four quadrants, which represent Kolb's learning styles. Adapted from *Organizational Behavior: An Experiential Approach* (6th ed.), (p. 149), by D. A. Kolb, J. Osland, and I. Rubin 1995, Englewood Cliffs, NJ: Prentice-Hall, Copyright 1995 by Prentice-Hall.

Patsidou and Metallidou (2009) examined the reliability and validity of the LSI. While the researchers found the LSI's reliability satisfactory, they stated that the construct validity of the LSI was weakly supported.

**Learning profiles.** I created learning profiles based on the descriptions of the four types, accommodating, assimilating, diverging, and converging, of learners explained in Kolb, Osland, and Rubin (1995). The learning profiles included how these four types of learners perceive and process information as well as the fields of study in which each type of learner is likely to be found. The learning profiles were mainly used to evaluate the way the participants felt about the center tasks used in EDEP 201. In other words, when the participants expressed affinity towards or aversion for certain center tasks, their learning profiles were used to establish whether these

opinions were consistent with their learning styles and learning modes. See Appendix C for the learning profiles.

**Observations: field notes and journal entries.** I attended all 32 class sessions of EDEP 201. Every time I attended the class, I took notes on how the students interacted with their classmates, the course instructor, and the activity center tasks. After observing each class, I reflected on what I had observed in class and recorded my thoughts in a research journal.

**Semi-structured individual interviews.** Throughout the semester, I conducted semi-structured individual interviews with each of the 16 participants. Each interview lasted for about 25 to 30 minutes and focused on what the participants thought about the EDEP 201 CREDE classroom, especially the activity center tasks, and their LSI results. I also asked the participants whether or not the center tasks accommodated their learning preferences, and if so, how well the tasks accommodated their learning preferences. See Appendix D for the interview questions.

During the interviews, I first asked the participants' opinions on the center tasks they found to be more enjoyable, helpful, and engaging. I also asked the inverse of these questions. Then, I showed the participants their LSI results with the characteristics of the learning styles, into which they were categorized. I also showed the other learning styles' characteristics to them. Thus, the participants were able to discuss whether or not their LSI results reflected their learning preferences, and if so, they discussed the accuracy of their results. If the participants did not agree with their LSI results, they were asked to express how they felt about their learning styles and suggest other learning modes or learning styles they felt better reflected their learning preferences. The participants in this study were described using their original LSI results, regardless of their objections. However, these objections were noted by the researcher in order to examine which learning style, their selected learning style or their LSI learning style, would

better match their later responses. After the participants confirmed their learning styles, they were asked whether certain types of center tasks in EDEP 201 accommodated the characteristics of their selected learning styles. They were also asked whether certain types of center tasks did not accommodate their learning styles. Later, each participant was given the transcript of his or her respective individual interview and reviewed it for accuracy.

**Semi-structured focus group interviews.** Close to the end of the semester, I conducted nine semi-structured focus group interviews, which were divided into three sets: Set 1, Set 2, and Set 3. Each set was completed within a single session of class as one of the day's center activities. Thus, each set consisted of three focus group interviews of five to six participants and these interviews were completed as the students rotated through the center. I conducted one set per-week over the course of three consecutive weeks

I wanted to see the similarities and differences in peer interaction among those who had the same learning style and those who had different learning styles. Therefore, during Set 1, I grouped the participants by their learning styles, and during Sets 2 and 3, the focus group interviews consisted of participants with mixed learning styles.

Each focus group interview lasted for approximately 15 minutes, and the participants were asked a few follow-up questions. These follow-up questions were created using the constant comparative data analysis method. According to Merriam (2009), the constant comparative method is an ongoing inductive process of analyzing data in which initially collected data is used to inform the next step of data collection. I used data gained from Set 2 to create questions for Set 3. I also used data gained from the individual interviews to create questions for Sets 1 and 2 of the focus group interviews, which were conducted after the individual interviews. For example, during the individual interviews, the two application tasks,

core qualities and CREDE, were grouped together in one category. However, even though both activities focused on practical application, some of the participants made distinctions between the two tasks. Based on these responses, I designed some follow-up questions to gauge the participants' thoughts about the two application tasks. These follow-up questions were asked during Set 1 of the focus group interviews.

For the first five minutes of each focus group interview, the participants completed a free write about the given questions and then discussed them as a group. I asked the participants to free-write before they discussed for three reasons. First, I thought that some participants might feel more comfortable expressing their thoughts through writing. I also thought that free writing might assist the participants in organizing their thoughts, which may have led to more in depth discussions. Lastly, I thought that free writing might prevent the participants from copying each other's opinions. Below, I describe each set of the focus group interviews.

**Set 1.** The participants were asked their opinions on the two application center tasks and the skills required to complete the tasks: the CREDE application task and the core quality application task.

**Set 2.** The participants were asked their thoughts on the problems with the brainstorming task, which the majority of the participants stated was not helpful and/or not enjoyable during their individual interviews.

**Set 3.** The participants were asked their opinions on the follow-up brainstorming task, conducted at the teacher-led center, which many of the participants brought up, in relation to the initial brainstorming task, during Set 2 of the focus group interviews.

## Data Analysis

The LSI each participant filled out was scored according to the guidelines by Kolb et al. (1995). I reviewed my field notes and journal entries multiple times. I used open coding to summarize my field notes and journal entries as they were related to my research questions. According to Merriam (2009), open coding is the process of making notations next to any data that could possibly answer one's research questions. Most of the time, my open codes were the exact word(s) of the participants, key terms created based on the data, or ideas that occurred frequently in the data. Then, I used axial coding to group the open codes that seemed to be related. According to Corbin and Strauss (2008), axial coding is the process of grouping open codes together that seem to be connected. Through this process, I found some emerging themes and patterns. Other sources of data, the transcripts of individual interviews and the participants' free-writings, were analyzed using the same process as described above.

However, the transcripts of the audio recordings of the individual interviews were analyzed according to the interview questions. In other words, the 16 responses for each question were grouped together and then analyzed. This analysis followed the same steps as the analysis of my field notes and journal entries. The free-writings, which the participants completed before the focus group discussions, were also grouped together according to the questions and then analyzed in the same manner as my field notes and journal entries.

See Appendix E for an example of how I coded one page of my field notes. One of the codes found in the example was "initiative," which identified who took the initiative in the group discussion. Another code was "lead," which identified who led the group discussion.

See Appendix F for an example of how I coded a transcript from one of the individual interviews I conducted. The codes found in the example were "reflect," and "not reflect." These

codes denoted which parts of the LSI results the participant agreed with and which parts the participant did not agree with.

See Appendix G for an example of how I coded a free writing assignment completed by a participant during one of the focus group interviews. One of the codes found in the example was “core quality,” which denoted that the participant preferred the core quality application task more than the CREDE application task. The codes “personal experience,” and “intuition,” denoted the reasons why the participant liked the core quality application task.

It is important to note that triangulation was not used in this study. Merriam (2009) described triangulation as “the use of multiple investigators, sources of data, or data collection methods to confirm emerging findings (p. 229).” Even though I used several methods to collect data, with the exception of classroom observations, the data was collected in a sequential order using the constant comparative analysis method. More specifically, I conducted the individual interviews first and then focus group interviews later. Therefore, rather than finding common themes in the data using the aforementioned methods, I was able to find more general themes in the data collected through the individual interviews, and find more specific themes on the same topics in the data collected through the focus group interviews. For example, during the individual interviews, the two application tasks, core qualities and CREDE, were grouped together in one category, and I found that both accommodating and converging learners liked the application tasks. However, some of these learners made distinctions between the two tasks even though both tasks focused on practical application. Based on these responses, I designed some follow-up questions to gauge the participants’ thoughts on the two application tasks. These follow-up questions were asked during the focus group interviews, and I found a more specific theme related to the application tasks. This theme was that all the convergers in EDEP 201

preferred the CREDE application task more than the core quality application task, and the majority of accommodators preferred the core quality application task more.

Unlike the case of the individual and focus group interviews, my classroom observations and the individual interviews were conducted simultaneously throughout the semester. There were several themes regarding the same topics found in both my classroom observations and the individual interviews. However, since three to four center tasks were conducted simultaneously in EDEP 201, and the members of each center changed every time the students rotated from one center to another, I found only a couple of general themes through my classroom observations. On the other hand, through the individual interviews, I was able to find more specific themes that were crucial in answering my research questions. For example, through classroom observations, I found that during the Final Word task, the participants regardless of their learning preferences tended to select their quotes based on feelings and personal experience. Through the individual interviews, I found which type of learner preferred or did not prefer the Final Word task, and both types of learners typically mentioned the use of feelings and personal experience in the Final Word task as the reasons why they preferred or did not prefer the task. Similar instances occurred while I was collecting data on the discussion paper and core quality application tasks, using my classroom observations and the individual interviews.

In conclusion, my classroom observations yielded themes that were related to patterns in student interaction, and most of them were not related to learning preferences. The data collected through the individual interviews were related to the learning preferences of the participants and yielded a general outline of student learning preferences in EDEP 201. This basic outline was used to design the questions for the focus group interviews. The data collected through the focus group interviews added information to the general outline of student learning preferences in



EDEP 201, which was initially constructed using the individual interview data. In addition, the data collected through the focus group interviews filled in information that was missing from the general outline. Thus, because of the differences in the methods of data collection used, in terms of sequence and the level of detail in the data they yielded, I did not use triangulation in this study.

### **My Role as a Researcher**

During my study, I interacted with the students in EDEP 201 in several ways. In the classroom, I mainly acted as an observer rather than a participant in class activities. In order to be as objective as possible, I kept my distance from the students and took notes on how they interacted with the tasks at different centers, as well as how focused the students were on the center tasks. Even though I was not taking the class for credit or working as a teaching assistant in the classroom, there were times when I played the role of a student or a teaching assistant. Depending on the needs of the instructor, I worked with an assigned partner(s) or led an activity center.

Since my thesis advisor was the instructor of the class I was observing, I may have had an overly positive bias towards her class. In an effort to guard against this, I looked for negative examples; for instance, while observing the class, I looked for negative examples, such as center tasks that did not proceed in the intended fashion or participants who were having a hard time understanding and completing their assigned center tasks. Additionally, I kept a research journal that prompted me to reflect on my research process, including my potential biases.

## Results

### Observations: Field Notes and Journal Entries

Throughout my observations of EDEP 201, I found three general themes. First, I found differences in the students' levels of interaction and task focus at the two different types of activity centers, teacher-led and student-led centers. Secondly, I found that most of the students who tended to take the initiative, talk at higher rates than others, dominate the conversations, change the topics of discussions, and/or lead the discussions were classified as accommodating learners. Lastly, I found patterns in student interaction in the following three center tasks: the Final Word, discussion paper, and core quality application tasks.

#### **Student interaction and task focus at the teacher-led and student-led activity centers.**

Compared to the teacher-led center where the instructor introduced a topic and led the discussion, the students took more time to engage with the center tasks at the student-led centers. For the first couple of minutes, the students figured out what they were supposed to discuss by reading the task prompts. Then, there was usually silence until someone started the conversation. Based on the observations I recorded in my field notes, at the student-led centers, except for two cases, all of the students who initiated the discussions were accommodating learners. Furthermore, I found that in almost every instance in which there were no accommodating learners at a student-led center, it took a long time for the students to begin their group discussions. In addition, at the student-led centers, the discussions on the given topics were shorter than the discussions at the teacher-led centers. The students tended to partially complete their assigned tasks. For example, in one of the CREDE application tasks, the prompt instructed the students to rate one teacher's lesson from the assigned reading using the COR (Luning et al., 2011). However, the students simply discussed whether or not the CREDE Standards were present in the teacher's lesson. At

another student-center, the students were required to discuss the core qualities they found in their peer teachers and categorize the core qualities into their appropriate categories: thinking, feeling, or action. The students were also required to discuss the core qualities they observed in themselves while being taught. However, the students at this center only discussed the core qualities they found in their peer teachers.

Furthermore, the students at the student-led centers tended to discuss the given topics in a broader context, and they eventually digressed from the intended topics. The instructor also acknowledged that without her guidance, the students at the student-led centers tended to have more relaxed conversations with their peers about the given topics and did so in a broader context (L. Yamauchi, personal communication, October 11, 2012). On the days that I observed the class, I always made entries in my field notes. Based on these data, I found that at least once a day, the students discussed a task topic in a broad context and eventually went off topic. For example, at one student-led center, the students were required to discuss how the teachers they observed used the CREDE model. One group of students at the center discussed many things centered around the topic. They first discussed the CREDE Standards that stood out in the lessons of the teachers they observed. Then, they shared the conversations they had with the teachers they observed. In these conversations, they stated that after interviewing the teachers, they were able to understand why the teachers taught their students in a particular way. While the task's prompt was only concerned about how the CREDE model was used, the broader discussion the students had allowed the task to include not only "how" but also "why" the CREDE model was used.

At another student-led center, the broader discussion was not as productive. This center task required each student to choose a teacher from the readings and discuss the core qualities of

the teacher. One student at the center talked about the core qualities of the music teacher he selected from the readings. Then, the student started talking about his music class and the other classes he was taking. The group followed suit and started talking about their classes and the assignments they needed to complete by the end of the week.

On the other hand, at the teacher-led centers, with the instructor's guidance, the students engaged with the tasks sooner, stayed on topic longer, and fully completed the tasks by covering all the details. For example, at one teacher-led center, each student was required to choose a teacher from the assigned reading and use Korthagen's (2004) Onion Model to discuss how the teacher addressed classroom issues. The students were also required to talk about how this reflected the teacher's core qualities. At the student-led centers, the students usually discussed only one or two things assigned in the tasks and talked about something else for the rest of the time. However, at this teacher-led center, the discussion stayed on topic, covering all the required aspects of the task. The students discussed the teachers' environments, such as society and classroom, as well as the core qualities of the teachers. The students also discussed how the teachers' core qualities influenced the way the teachers dealt with classroom issues.

Additionally, at the teacher-led centers, whenever the students discussed the intended topics of the center tasks in a broader context, the instructor brought their attention back to the intended topics by using guiding questions. For example, in one teacher-led center, the students had to share their own core qualities that came out during their observations. During this task, a student discussed how the teacher he observed managed the class. The instructor guided the student back to the intended topic, his own core qualities, by asking the following questions: "What does it say about you and your core qualities?" and "Can you think about your own core qualities in that scenario?" The student started sharing his beliefs related to the scenario. The

instructor told the student that beliefs were closely related to core qualities. With the instructor's help, the student was able to discern his own core qualities, such as determination, within the information he had shared.

Furthermore, compared to the student-led centers where some students often dominated the discussions, at the teacher-led centers, every student participated in the discussions. The discussions at the teacher-led centers were almost always directed by the instructor's questions, and the instructor asked questions to every student. The students who tended to take the initiative, talk at higher rates than others, and lead the discussions at the student-led centers, also tended to take the initiative when responding to the instructor's questions at the teacher-led centers. However, since every student was individually asked to answer the instructor's questions, the time each student took to share their thoughts was approximately the same. The instructor usually responded to every student's answer. The instructor also provided the students with specific corrections when necessary. For example, at a teacher-led center where the students were required to identify the core qualities of people they respected, a student put forth, "guiding," as a core quality. The instructor corrected the student by explaining, "In the model [Korthagen's (2004) Onion Model], guiding is more like a behavior rather than a core quality."

At the teacher-led centers, the discussions were contained within the scope of the instructor's questions, such that the students' answers and their explanations were usually short. While there was a substantial amount of interaction between the instructor and the students at the teacher-led centers, there was less peer-to-peer interaction. The instructor asked questions to each student and almost always responded to each student's answer. There were also times when the students responded to their peers, but not as often as the instructor. Most of the students who responded to their peers at the teacher-led centers were also accommodating learners.

### **Student interaction in the Final Word, discussion paper, and core quality**

**application tasks.** I discovered several patterns in student interaction in the Final Word, discussion paper, and core quality application tasks. First, during the Final Word tasks, the reasons the students selected their quotes and the comments they received from their group members were usually based on feelings and personal experience. The instructor said that the Final Word tasks were intended to be concept based but became a feeling based task in practice (L. Yamauchi, personal communication, October 11, 2012). For example, in one of the Final Word center tasks, the quote a student selected was “Do not think that because a child cannot read a text, he cannot read you” (Rose, 1995, p. 17). The student stated, “I chose this quote because teachers’ expectations can influence how students learn.” Another student responded to this quote, “We do not need words because we can feel.” In another Final Word center task, the quote a student chose was “ The words BOSNIA, EL SALVADOR, KUWAIT, VIETNAM flash in red across the screen; at the end we freeze on IF THIS WAS OUR PAST, LET’S NOT MAKE IT OUR FUTURE” (Rose, 1995, p. 21). The student stated, “I chose this quote because I had served in the military for a long time, and having been exposed to human pain, suffering, and death, I feel that we as people need to put value in our lives and the lives of others.”

Secondly, the discourse the students engaged in during the discussion paper tasks was centered around the course concepts embedded in the given discussion paper prompts. The feedback the students offered each other while completing the tasks was also concept-focused; they compared the ideas in their papers to the ideas of their peers. For example, in one of the discussion paper tasks, each student selected a teacher in the assigned reading and discussed the teachers’ core qualities. In an assignment prepared for this task, the students had already selected and written about a teacher from the reading. The majority of the students selected the same

teacher, Mrs. Castro. However, the core qualities the students found in Mrs. Castro were somewhat different. One student discussed the teacher's thinking and action core qualities, such as adaptation and capability. The student explained that Mrs. Castro used her bilingual students to help the other students and used her resources, in this case the bilingual students, to improve her teaching. On the other hand, another student discussed Mrs. Castro's feeling core qualities, such as caring and passion, while stating, "Mrs. Castro seemed to respect the cultural and linguistic differences." Even when the instructor told the students to write about anything they found interesting in the assigned reading, all the students except for one wrote about the concepts they learned in class, such as Korthagen's (2004) Onion Model and the CREDE Five Standards.

Lastly, during the core quality application tasks, the students often referenced their own intuition and personal experience when deciding how to categorize core qualities. In one of the core quality application tasks, each student was required to think of a person they admired and identify the person's core qualities. In addition, they were required to categorize the person's core qualities into the following groups: thinking, feeling, or action. One student shared her father as an example and the group came up with several core quality terms to describe the student's father. One of the terms was "innovative," and the opinions of the students as to which category the term "innovative" belonged were split between the action and thinking categories. A student stated that the term "innovative" belonged to the action category because when he tried to produce something innovative, it usually required him to take some risks. According to another student, the term "innovative" belonged to the thinking category because he felt the term was related to "thinking of new ideas that can help people."

### **Semi-Structured Individual Interviews**

From the 16 semi-structured individual interviews, I found themes and patterns that were crucial in answering my research questions. The research questions of this study were: How effectively do CREDE activity center tasks accommodate students with different learning preferences? How is the learning preference congruence of center tasks related to students' perceptions of their levels of engagement in center tasks, their enjoyment of center tasks, and the extent to which center tasks are helpful in understanding class concepts?

Mainly, three themes were found in the data gained from the individual interviews. The first theme was a relationship between the center tasks that the participants stated accommodated their learning preferences and the center tasks they found to be more enjoyable, helpful, and engaging. The second theme was a relationship between the center tasks the participants stated did not accommodate their learning preferences and the center tasks they found to be less enjoyable, helpful, and engaging. The third theme was that except for the drawing task, there was a relationship between participants who had the same learning style and certain EDEP 201's center tasks. Additionally, the results from the individual interviews confirmed the accuracy of the LSI results.

First of all, in the interviews, most of the participants confirmed their LSI results, which included their learning styles. According to the LSI results, there were two assimilating, two converging, six accommodating, and six diverging learners in EDEP 201. Except for two, all the other 14 participants stated that overall their LSI results accurately reflected their learning preferences. One converging learner stated, "A lot of these things reflect the way I learn." One assimilating learner said, "I think the LSI [results] perfectly matches my learning preferences." One diverging learner stated, "I think a lot of them [the characteristics of the learning style from



my LSI results] reflect my learning preferences.” One accommodating learner mentioned, “I do believe that they [my LSI results] reflect my learning preferences.”

Furthermore, of the fourteen participants who agreed with their LSI results, three participants pointed out the fact that their positions on the LSI grid accurately reflected their learning preferences. See Figure 3 on p. 41 for the LSI grid. For example, one assimilating learner’s results were positioned deep within the thinking side of the perceiving continuum on the LSI grid, which served as the y-axis of the grid. The perceiving continuum is divided between the feeling side and the thinking side (Kolb et al., 1995). The learner was also positioned near the middle of the processing continuum, on the observing side but still close to the doing side. The processing continuum served as the x-axis of the LSI grid, and the continuum is divided between the doing side and the observing side (Kolb et al., 1995). The learner stated, “I totally agree that I don’t rely on my feelings as much as my thinking.” He also said, “I like to watch before doing, but I agree with the LSI [results]. Sometimes, I do things, but most of the time, I watch before doing.”

One of the two participants who did not agree with their LSI results fell into the diverging learning style, which is made up of the feeling mode and the observing mode. The learner stated that the feeling mode reflected her learning preferences, but not the observing mode. She stated, “I think I like doing rather than just watching somebody else do stuff.” In other words, the participant, who was a diverging learner according to her LSI results, stated that she was an accommodating learner.

The other learner who also did not agree with his LSI results fell into the accommodating learning style, which is a combination of the feeling mode and the doing mode. The learner stated that the doing mode reflected his learning preferences, but not the feeling mode. The

learner stated that he was a thinker rather than a feeler, “When I do class assignments with my friends, I am analytical. My friends also agree with this.” In other words, the participant, who was an accommodating learner according to his LSI results, stated that he was a converging learner.

**Relationship between the center tasks the participants stated accommodated their learning preferences and the center tasks they found to be more enjoyable, helpful, and engaging.** This theme emerged after comparing four questions in the individual interviews. The participants were first asked about the center tasks that they found to be more enjoyable, helpful, and engaging. Enjoyment, helpfulness in understanding class concepts, and engagement each had their own respective question. Then, the participants were asked about the center tasks that accommodated their learning preferences. When the answers to these four questions were compared, a pattern emerged. Except for three participants, the center tasks which the remaining 13 participants stated accommodated their learning preferences included the tasks that they found to be more enjoyable, helpful, and engaging. The center tasks the three dissenters mentioned accommodated their learning preferences included the tasks that they found to be enjoyable and helpful, but not engaging.

**Relationship between the center tasks the participants stated did not accommodate their learning preferences and the center tasks they found to be less enjoyable, helpful, and engaging.** This theme emerged after comparing four questions in the individual interviews. The participants were first asked about the center tasks that they found to be less enjoyable, helpful, and engaging. Enjoyment, helpfulness in understanding class concepts, and engagement each had their own respective question. Then, the participants were asked about the center tasks that did not accommodate their learning preferences. When the answers to these four questions were

compared, two patterns emerged. Before explaining these two patterns, it is important to note that three participants mentioned that all the center tasks in EDEP 201 accommodated their learning preferences, so these learners were omitted from the following results. The center tasks that seven out of the thirteen participants mentioned did not accommodate their learning preferences included all the tasks they found to be less enjoyable, helpful, and engaging. There was another pattern dealing with helpfulness. Except for one participant, the center tasks that the twelve remaining students mentioned did not accommodate their learning preferences were consistent with the tasks that they found to be less helpful.

### **Relationships between learners and center tasks.**

*Relationship between diverging learners and the Final Word task.* All of the six diverging learners in EDEP 201 chose the Final Word task, out of all the center tasks in EDEP 201, as the task that accommodated their learning preferences. All six diverging learners highlighted the part of the task that allowed them to see different perspectives, the differing opinions of group members on the same quote. One diverging learner mentioned, “I thought it was interesting to see everyone point out why they chose their quote.” Another diverging learner said, “There will be a student that comes out with a different point of view. Those are the times I like the task.” On top of this part of the task, four out of the six diverging learners also mentioned the feeling aspect of the task. A diverging learner mentioned that because he and his classmates spontaneously responded to each other’s quotes, their responses were more feeling based and less analytical. The learner stated he selected his quotes based on his feelings, “Once I know what I feel the strongest about, I can figure out how to learn from there.” Another diverging learner said, “We did not have to relate it [the quote] to any particular concept. We could relate it to any experience we had.”

Additionally, one diverging learner mentioned the unstructured aspect of the Final Word task. “That activity [The Final Word task] was kind of unstructured because it allowed me the freedom to choose whatever quotes I wanted and analyze them however I wanted.”

***Relationships between assimilating learners, the discussion paper task, and the Final Word task.*** The two assimilating learners in EDEP 201 stated that the discussion paper task accommodated their learning preferences. They both mentioned the multi-perspective aspect of the discussion paper task, which allowed them to see the different perspectives of others on a given prompt. They also mentioned the conceptual aspect of the task. Assimilating Learner A said, “It [the discussion paper center task] focuses more on ideas and concepts.” Assimilating Learner A also mentioned, “The discussion paper task helps me look for the meaning of concepts.”

Like Assimilating Learner A, Assimilating Learner B stated that the discussion paper center task was helpful. However, Assimilating Learner B put more emphasis on the concept-focused aspect of the task. Assimilating Learner B mentioned that depending on the prompts for the discussion papers, sometimes discussion paper tasks were not helpful. To this point, Assimilating Learner B stated, “I found the discussion paper helpful when we had to answer a question about a concept, such as core qualities, but I did not find the discussion paper helpful when we had to answer questions based on personal stories or feelings.” Additionally, Assimilating Learner B mentioned, “Though the personal stories were interesting, I did not learn anything valuable from the past experiences and stories of my classmates.”

On the other hand, Assimilating Learner A stated that the majority of the discussion paper prompts focused on concepts. The learner said, “I felt that Lois [the instructor] did this to help us practice and put the concepts to use.” Assimilating Learner A also mentioned that people

discussed their life experiences during the discussion paper tasks, but she said that they were related to the concepts covered in class. Assimilating Learner A further explained how these discussions helped her better understand concepts, “I felt that relating and reflecting my experiences help me better understand a concept.” Assimilating Learner A also stated that she was able to relate her classmates’ experiences to her life, which also helped her understand concepts.

Both of the two assimilating learners stated that the Final Word task did not accommodate their learning preferences. Both learners appreciated the multi-perspective aspect of the Final Word task. However, they stated that the task was not really related to the concepts covered in class, so they found the task to be ineffective and not helpful. Assimilating Learner A stated, “It’s interesting how people say different things about it [the quote selected], but I just don’t understand how it relates to concepts we are learning.” Assimilating Learner B concurred with this criticism, “Some of the quotes and reasons did not teach me anything related to the class unless they involved the [class] concepts.”

***Lack of distinct relationships between the drawing task and learners with a specific learning style.*** During the individual interviews, the students were asked, “Which activity center task(s) accommodated your learning preferences and how did that (those) center task(s) accommodate your learning preferences?” Only two learners, one diverging and one accommodating, in the class mentioned that the drawing task accommodated their learning preferences. Both learners stated they liked the creative aspect of the drawing task. In addition, the diverging learner included the multi-perspective aspect of the task in her reasoning. To this point, the diverging learner stated, “I liked to see everyone’s creative abilities, and how they related words to pictures.” On the other hand, the accommodating learner emphasized the active

aspect of the task. This learner stated that she liked the drawing task because it was a hands-on activity.

***Relationship between the brainstorming task and learners transcends learning style.***

Only two diverging learners in EDEP 201 stated that the brainstorming task accommodated their learning preferences. Both learners mentioned that they enjoyed brainstorming core qualities as a group. One of the diverging learners stated that she liked the brainstorming task rather than the drawing task because unlike the brainstorming task, the drawing task did not give her an opportunity to brainstorm core qualities with her group members. Except for these two diverging learners and a few others, most of the class stated that the brainstorming task was neither helpful nor enjoyable. Only three learners clarified their reasons for this. One learner mentioned the brainstorming task's lack of precision, and the other two learners mentioned that the task did not make use of life experiences. In order to figure out the opinions of the rest of the participants on the problems related to the brainstorming task, follow-up questions regarding this were asked in the focus group interviews.

***Relationships between the application tasks, accommodating learners, and converging learners.*** During the individual interviews, the two application tasks, core qualities and CREDE, were grouped together in one category. Both accommodating and converging learners liked the application tasks. However, even though both tasks focused on practical application, some of these learners made distinctions between the two tasks. One accommodating learner stated that she liked the application tasks in general, but particularly liked the core quality application task more. To this point, the learner said, "It [the core quality application task] involved my own judgment and experience . . . . This allowed me to connect better to the concept and helped me remember the thinking, feeling, and action words." Based on this and similar responses, I

decided to further explore the distinctions between the two application tasks with follow-up questions in the focus group interviews.

### **Semi-Structured Focus Group Interviews: Free Writing and Discussions**

The results of the focus group interviews mainly presented three themes. The first theme was that participants who had the same learning style preferred the same center tasks, and this theme was found in Set 1 of the focus group interviews. When data from the individual interviews was combined with the data from Set 1 of the focus group interviews, it was apparent that the majority of accommodators preferred the core quality application task and all the convergers preferred the CREDE application task. The second theme was that participants who only shared a learning mode also preferred the same center tasks, and this theme emerged from all three sets of the focus group interviews. In the data from the focus group interviews, there were several instances in which participants, who had different learning styles but shared a learning mode, preferred the same center tasks. Lastly, I found that when participants with different learning styles worked together, there was more interaction and less agreement among them, compared to when participants with the same learning style worked together.

**Set 1.** The data gained from Set 1 of the focus group interviews illustrated two points. First, the data articulated the two groups of participants who shared the same learning mode on the perceiving continuum (Kolb, 1984) each preferred a different application task. One group was composed of assimilating and converging learners who shared the thinking mode. The other group was made up of accommodating and diverging learners who shared the feeling mode. Each group preferred a different application task. Secondly, when combined with data from the individual interviews about the tasks that accommodated those who shared the doing mode on

the processing continuum (Kolb, 1984), the data from Set 1 demonstrated that the accommodating and converging learners in EDEP 201 each preferred a specific application task.

All the assimilating and converging learners who shared the thinking mode on the perceiving continuum (Kolb, 1984) preferred the structured framework which the COR (Luning et al., 2011) provided in the CREDE application task. One converging learner stated, “The CREDE rubric [COR] was clearer because it had a set of rules that we could follow unlike core qualities that had no specific guidelines.” One of the assimilating learners stated, “Set boundaries and rules make the activity [the CREDE application task] easier to understand.”

Eight out of the twelve accommodating and diverging learners who shared the feeling mode on the processing continuum (Kolb, 1984) preferred the intuition based decision making and the use of personal experience in the core quality application task. One accommodating learner stated, “Though the CREDE rubric [COR] is clear-cut, intuition and personal experience allowed me to better remember the application [of core qualities]. I felt more engaged with that activity [the core quality application task].” Another accommodating learner stated that he liked the intuition-based approach used in the core quality application task because it allowed him to make connections between the concept and his personal experiences in real life. One diverging learner stated, “I like the personal approach used in the core quality application task more because I like to relate my class work to my own life.”

Taking into account that all the accommodating and converging learners agreed that the application tasks, core quality and CREDE, accommodated their learning preferences, the data from Set 1 of the focus group interviews enabled me to discern which application task best accommodated these learners. The core quality application task best accommodated four of the



six accommodating learners in EDEP 201. On the other hand, all the converging learners were best accommodated by the CREDE application task.

**Set 2.** The data revealed that participants who shared a common learning mode on the perceiving continuum (Kolb, 1984) cited similar problems with the brainstorming task. Except for four students, all the other participants who shared the feeling learning mode, eight accommodators and divergers in EDEP 201, criticized the fact that the abstract focus of the brainstorming task did not allow them to use personal experience. The eight learners stated that if the brainstorming task had provided them with real life examples or allowed them to use personal experience, they would have better understood the concept of core qualities and completed the task. An accommodating learner stated, “If someone used life experience within the lesson [the brainstorming task], I could picture it in my mind. I would have a better understanding when there is a specific context.” Another accommodating learner said, “I like contextualizing core qualities within real life experience because it strengthens my understanding of the topic.” A diverging learner stated, “Being able to use my own context when identifying core qualities would help me because I could easily identify them and associate them with actions based on what I have seen and done in my life.”

Of the four assimilating and converging learners in EDEP 201, who shared the thinking mode, all of them except for one assimilating learner, cited the brainstorming task’s lack of precision as an issue that stifled their learning. These three learners stated that if the task had used a formula or a set of rules for categorizing core qualities, they would have easily completed the task. One assimilating learner mentioned that during the brainstorming task, he and the other students in his group were confused because the criteria for categorizing core qualities was not clear. The learner stated, “Many of the [core] qualities were in multiple categories because the

core quality activity had no written criteria or standards.” In addition, one converging learner stated, “I would have liked more explanation [as] to how we were supposed to do the [brainstorming] activity. A formula for categorizing core qualities would have helped.”

The discussions during Set 2 of the focus group interviews did not end with the problems regarding the brainstorming task. The discussions continued about the follow-up brainstorming task, which was conducted at a teacher led center. Due to the fact that the charts categorizing core qualities were incorrectly completed during the brainstorming task at a student-led center, the instructor repeated the task at a teacher-led center (L. Yamauchi, personal communication, September 13, 2012). However, only the last two out of the three focus groups conducted during Set 2 discussed the follow-up brainstorming task. This prompted me to ask the participants about their opinions on the follow-up brainstorming task in Set 3 of the focus group interviews.

**Set 3.** The data revealed that all of the participants stated that they liked the follow-up brainstorming task, conducted at the teacher-led center. They also stated that the follow-up brainstorming task was an improvement over the original. However, I found that participants who shared a common learning mode on the perceiving continuum (Kolb, 1984) cited similar reasons for the improvement.

In the follow-up brainstorming task, the instructor asked the students to discuss people they admired. This invited the students to contextualize the task within personal experience, which helped many accommodating and diverging learners based on their self-reports. One accommodating learner stated, “Dr. Yamauchi helped fill the gap [in the first brainstorming task] for me with contextualization by using core qualities from my favorite teachers in the past.” One diverging learner stated, “The second brainstorming activity was better because we got to use our

own experiences and people we know to define [core] qualities rather than just pulling words out of the air.”

Then, the instructor guided the students in categorizing the identified core qualities. The guidance in the teacher-led brainstorming task provided more precision than the student-led brainstorming task. The additional precision provided by the instructor at the follow-up brainstorming activity assisted three out of the four converging and assimilating learners based on their self-reports. The assimilating learner, who had stated earlier that the brainstorming task was confusing, mentioned, “Mrs. Yamauchi provided a more precise explanation as to why certain core qualities belonged to certain categories. This helped me understand the three categories of core qualities.” One converging learner stated, “The brainstorming activity lacked precision. After Professor Yamauchi provided precision, I found it to be very helpful.”

Lastly, during Set 1 of the focus group interviews, I found that when the participants were grouped according to their learning styles, there was more agreement than disagreement. The discussions in the groups in which the participants had the same learning style were much shorter than the discussions in the groups in which learning styles were mixed. During Sets 2 and 3 of the focus group interviews, the groups consisted of participants with different learning styles. In these groups, there was a greater variety of responses to the given questions; the participants explained their reasoning in more detail, sometimes with examples.

### **Learning Profiles**

In this section, the learning profiles were compared with the results of the study. As the data showed, the participants of each specific Kolb (1984)’s learning style had similar opinions about EDEP 201’s certain center tasks. It also showed that participants who shared a common learning mode had similar opinions concerning certain aspects of a few center tasks in EDEP 201.

The learning profiles were used to evaluate whether these opinions were consistent with the characteristics of Kolb's learning styles and learning modes. The learning profiles were also used to explore the responses of the two learners who did not agree with their LSI results. Lastly, the learning profiles were used to see if the participants were majoring in the fields of study listed in their learning profiles.

**Center tasks and fully accommodated learners.** All of the six diverging learners in EDEP 201 chose the Final Word task as the task that accommodated their learning preferences. The shared opinion of the diverging learners can be explained by their learning profile. According to the learning profile of diverging learners, diverging learners learn through reflective observation, the watching learning mode (Kolb et al., 1995). Thus, they are good at looking at things from different perspectives and appreciate different points of view. The individual interviews showed that all six diverging learners in EDEP 201 highlighted the part of the Final Word task that allowed them to see the different perspectives of their group members on the same quotes. One diverging learner mentioned, "I thought it was interesting to see everyone point out why they chose their quote."

Furthermore, according to their learning profile, diverging learners perceive information by feeling rather than thinking (Kolb et al., 1995). Based on data from the individual interviews, four out of six diverging learners in EDEP 201 mentioned the feeling aspect of the Final Word task. One diverging learner stated he selected his quotes based on his feelings, "Once I know what I feel the strongest about, I can figure out how to learn from there."

All of the assimilating learners in EDEP 201 chose the discussion paper task as the task that accommodated their learning preferences. The shared opinion of the assimilating learners can be explained by their learning profile. According to their learning profile, assimilators learn

through abstract conceptualization, the thinking learning mode (Kolb et al., 1995). Thus, they focus on ideas and abstract concepts. They value ideas that are theoretically logical and precise over ideas that have practical use. They also prefer a scientific rather than artistic approach to problem solving. In the individual interviews, all of EDEP 201's assimilating learners mentioned the concept-focused aspect of the discussion paper task; they stated that the task required them to think about and analyze class concepts.

The other learning mode that comprises the assimilating learning style is the watching or reflective observation mode (Kolb et al., 1995). This denotes that assimilators enjoy looking at things from different points of view and appreciate the perspectives of others. Moreover, they focus on understanding the meaning of ideas. According to the individual interviews, all the assimilating learners in EDEP 201 mentioned the multi-perspective aspect of the discussion paper task, which allowed them to see the different perspectives of their peers on the given prompts. They also mentioned that the task helped them discern the meaning of class concepts.

During the individual interviews, the two application tasks, core qualities and CREDE, were grouped together in one category. Data from the individual interviews showed both the converging and accommodating learners in EDEP 201 stated that the application tasks accommodated their learning preferences. This can be supported by the learning profiles of accommodators and convergers. According to their learning profiles, these two types of learners share the doing or active experimentation mode (Kolb et al., 1995). As a result of this, the learners have an affinity for learning through practical application.

Even though both the core quality and CREDE tasks focused on practical application, some of the learners who were accommodated by the tasks made distinctions between them. Based on their responses, I asked follow-up questions to explore the distinctions between the two

application tasks during the focus group interviews. Data from the focus group interviews demonstrated that all the converging learners in EDEP 201 preferred the CREDE application task more than the core quality application task. These learners especially preferred the COR (Luning et al., 2011), which was used in the CREDE application task. One converging learner stated, “The CREDE rubric [COR] was clearer because it had a set of rules that we could follow unlike core qualities that had no specific guidelines.” This is consistent with the learning profile of convergers. According to their learning profile, converging learners value precision, discipline, and a well-structured system when analyzing ideas (Kolb et al., 1995).

Furthermore, data from the focus group interviews illustrated that most accommodating learners, four out of six, preferred the core quality application task more than the CREDE application task. These learners especially preferred the intuitive decision-making process and personal experience used in the core quality application task. One accommodating learner stated, “Though the CREDE rubric [COR] is clear-cut, intuition and personal experience allowed me to better remember the application [of core qualities]. I felt more engaged with that activity [the core quality application task].” This can be supported by the learning profile of accommodators. According to their learning profile, accommodating learners prefer sharing personal experience, solving problems in an intuitive and artistic way, and working in unstructured situations (Kolb et al., 1995). To sum up, when the data from the individual and focus group interviews were combined, the results demonstrated that the accommodators and convergers were each accommodated by a different application task.

**Center tasks and partially accommodated learners.** The data from the individual and focus group interviews demonstrated that participants who shared a common learning mode had similar opinions concerning certain aspects of a few center tasks in EDEP 201. The responses of

accommodators and convergers in the individual interviews showed that they both liked the practical application aspect of the two application tasks: the core quality application task and the CREDE application task. This is supported by the doing learning mode that both accommodators and convergers share in their learning profiles (Kolb et al., 1995).

Furthermore, the responses of accommodating and diverging learners in the focus group interviews showed that these learners enjoyed the intuitive decision making process used in the core quality application task. The feeling mode these learners share in their learning profiles (Kolb et al., 1995) supports this mutual affinity. The pattern repeats itself with assimilating and converging learners, who both liked the precise and well-structured system for analyzing ideas in the CREDE application task. This is supported by the thinking mode these learners share in their learning profiles (Kolb et al., 1995). However, this pattern does not continue in the Final Word center task. Both divergers and assimilators mentioned that the multi-perspective aspect of the Final Word task was interesting. This is supported by the watching mode these learners share in their learning profiles (Kolb et al., 1995). The assimilators in EDPE 201 unanimously disliked the Final Word task, despite that the watching mode present in their learning style denotes that the assimilators should have enjoyed the Final Word task because of its multi-perspective characteristic.

**Learners who did not agree with their LSI results.** Among the two participants who did not agree with their LSI results, one was a diverging learner according to her LSI results. However, the learner felt that she was an accommodating learner. Despite her insistence that she was an accommodator, the learner's subsequent responses during my study were consistent with her LSI results, which categorized her as a diverging learner. In other words, the learner's subsequent responses were more consistent with the learning profile of diverging learners rather

than the profile of accommodating learners. The learner did not mention any center tasks, which the majority of the accommodating learners in EDEP 201 selected as the tasks that accommodated their learning preferences or the tasks they found to be enjoyable. Instead, she selected the Final Word task as the task that accommodated her learning preferences, similar to all the other diverging learners in class. In addition, her reason for preferring the Final Word task was consistent with the learning profile of diverging learners. According to their learning profile, diverging learners are good at looking at things from different perspectives, and they appreciate different points of view (Kolb et al., 1995). The learner stated, “I liked that one [the Final Word center task] because we were able to see the different perspectives of others.”

The other student who did not agree with his LSI results was an accommodating learner according to his LSI results. However, the learner felt that he was a converging learner. The learner’s subsequent responses were consistent with how the learner felt about his learning style. Data from the individual and focus group interviews supported that he was a converging learner rather than an accommodating learner. In other words, the learner’s subsequent responses were more consistent with the learning profile of converging learners rather than the learning profile of accommodating learners. Like the converging learners in EDEP 201, the learner selected the CREDE application task as the task that accommodated his learning preferences, and his reasoning for preferring the task was consistent with the learning profile of converging learners. According to their learning profile, converging learners value precision, discipline, and a well-structured system when analyzing ideas, and they like systematic planning (Kolb et al., 1995). In the CREDE application task, the COR (Luning et al., 2011) was the structured system used to analyze ideas in the task. The learner stated, “I liked the CREDE application activity because it was straight forward, and I could look at something [the COR] and directly relate it to the



activity.” In addition, the learner stated that the core quality application task, which the majority of the accommodating learners in class selected as the task that accommodated their learning preferences, did not accommodate his learning preferences. The learner’s reasoning for this also matched the learning profile of converging learners. The learner cited, “I like having a uniform formula for categorizing core qualities, but it [the core quality application task] didn’t [have a uniform formula].”

**The majors of the participants.** Approximately half of the participants had majors that were within or related to the fields of study in their respective learning profile. According to their learning profile, assimilators are frequently found in the basic sciences and mathematics (Kolb et al., 1995). Consistent with their learning profile, all the assimilators in EDEP 201 were math and science majors. In addition, four of the six diverging learners in EDEP 201 were majoring in the fields related to Liberal Arts and Humanities listed in their learning profile. However, all the convergers and half of the accommodators in EDEP 201 were not majoring in the fields of study listed in their respective learning profile. All the convergers were not physical science majors, and three of the six accommodators were not business, fine arts, political science, or psychology majors.

## **Discussion**

### **Theoretical Implications**

Kolb (1984) created the experiential learning model and the corresponding survey, the LSI. According to his theory, learners have preferences for certain learning modes, which to create learning styles. Consistent with Kolb’s ideas, my study results demonstrated that each of the participants had preferred learning modes and a preferred learning style.

My study also supports the accuracy of the characteristics Kolb (1984) assigned to the four learning styles in his model, as well as the accuracy of the LSI. Except for two, all the other participants agreed that their LSI results accurately reflected their learning preferences. Based on Kolb's theory, I created learning profiles to evaluate how consistent the responses of the participants were with their learning styles, which were determined by the LSI. The reasons the majority of the participants gave for preferring or disliking certain tasks corresponded to their respective learning profile. This supported that the participants' preferences were consistent with the characteristics of Kolb's (1984) learning modes and styles.

Even the two participants who disagreed with their LSI results felt that they were partially accurate. Both participants agreed with one of the two learning modes that comprised each of their respective learning styles. Moreover, the subsequent responses from one of the two learners during the course of my study were consistent with the learning style assigned by the LSI. However, the learner, whose LSI results determined that he was an accommodating learner, stated that his natural learning preferences were reflected by the LSI. However, the learner stated that he acted as a converging learner in order to be more successful in school. Data from the individual and focus group interviews showed that the learner's responses were consistent with the responses of the converging learners in EDEP 201.

Furthermore, Kolb (1984) explained that differences may exist even in those who have the same learning style depending on the extent to which their learning styles are defined. This idea is reflected in how LSI results are plotted on the LSI grid, see Figure 3 on p. 41. The place LSI results fall within the grid denotes a person's learning style and the strength of a person's preference for each learning mode that creates his or her learning style. The combined strength of

each learning mode determines the extent to which his or her learning style is defined. The results of my study supported this aspect of Kolb's theory.

In my study, differences were found in the responses of the two assimilating learners. Even though both learners thought the discussion paper center task helped them understand class concepts, their opinions about certain aspects of the task were different. Both learners found the concept-focused aspect of the discussion paper task to be beneficial. However, they had different opinions on the inclusion of personal experience in the task. Assimilating Learner A stated that she found incorporating personal experience into the discussion task to be helpful as long as it was related to the concepts being taught. However, Assimilating Learner B stated that he did not find the inclusion of personal experience into the discussion paper task to be helpful.

The difference between Assimilating Learner A and B can be explained using their LSI results. Both learners are positioned on the thinking mode side of the perceiving continuum (Kolb, 1984). However, compared to Assimilating Learner A, Assimilating Learner B was positioned deeper within the thinking mode and farther away from the feeling mode. In other words, while both learners preferred learning through the thinking mode, Assimilating Learner A was less averse to learning through the feeling mode. Since the use of personal experience was associated with the feeling mode, both Assimilating Learner A's more positive view of and Assimilating Learner B's more negative view of using personal experience were consistent with the strength of their respective preferences for the learning modes, feeling and thinking, on the perceiving continuum (Kolb, 1984)".

While the reasons most participants gave for preferring or disliking certain tasks in EDEP 201 were consistent with their learning profiles, only half of the participants had majors consistent with the fields of study listed in their learning profiles. This may be because most of

the participants were either freshmen or sophomores. Newcomb (1994) summarized data from multiple studies and stated that most studies showed that one-third to two-thirds of undergraduate students change their majors. Since most of the participants were freshmen or sophomores, they were taking introductory courses or had just started taking their major courses. Therefore, it is highly probable that some participants will change their majors before the end of their undergraduate careers.

### **Research Implications**

Many learning preference related studies I reviewed showed that there was a relationship between major and learning preference (Lashley & Barron, 2006; Shein & Chiou, 2011). Since the participants of EDEP 201 came from a diverse range of majors, I expected that EDEP 201 would have a variety of learning styles. Like the expectation I made based on the literature reviewed, all four types of Kolb's learners were present in EDEP 201. However, most of the participants, 12 out of 16, were either accommodating or diverging learners, and according to their learning profiles, these types of learners share the feeling mode (Kolb et al., 1995). Since different courses may attract different types of learners (Severiens & Dam, 2007; Shein & Chiou, 2011), it is possible that EDEP 201, which was designed for those aspiring to become teachers, attracted accommodators and divergers who are more feeling oriented learners. Conversely, assimilators and convergers who are thinking mode learners may be less inclined to enroll in courses like EDEP 201.

Furthermore, the majority of the learning preference related studies I reviewed, eight of eleven, demonstrated that there was some type of positive relationship between learning preference congruent teaching and learning outcomes. However, after reviewing the learning preference related studies, I found two overarching limitations that complicate learning

preference congruent teaching: practicality and diversification in instructional strategies. Based on the literature reviewed (Doherty & Hilberg, 2007; Hilberg et al., 2003), I concluded that the CREDE model would facilitate learning preference congruent teaching while substantially mitigating the two limitations regarding learning preference congruent teaching.

A CREDE-based classroom could make learning preference congruent teaching more practical by accommodating multiple learning preferences at the same time. This is possible because in a CREDE classroom, there are multiple activity centers, at which different center tasks are simultaneously conducted (Doherty & Hilberg, 2007; Hilberg et al., 2003). If the simultaneously conducted tasks accommodate a variety of learning preferences, the model would make learning preference congruent teaching feasible within the time constraints of an average class session.

Concerning the first limitation of practicality, which I found after reviewing the literature on learning preferences, the study results were consistent with the expectation I made based on the literature reviewed related to CREDE. The study results showed that the instructor of EDEP 201 organized her CREDE classroom in a manner that successfully dealt with the limitation of practicality. The instructor was able to accommodate students with different learning styles within the time constraints of each class session by using various types of simultaneously conducted activity center tasks. Each of the four center tasks, conducted on a regular basis in EDEP 201, accommodated the participants of a specific learning style defined by Kolb (1984). All of the six diverging learners in EDEP 201 chose the Final Word task as the task that accommodated their learning preferences. All of the assimilating learners in EDEP 201 stated that the discussion paper task accommodated their learning preferences. The majority of the accommodating learners in class, four out of six, stated that the core quality application task

accommodated their learning preferences. All of the converging learners in class selected the CREDE application task as the task that accommodated their learning preferences. In addition, the participants' reasons for preferring or disliking certain center tasks matched their learning profiles. This supported that the participants' preferences were consistent with the characteristics of Kolb's (1984) learning modes and styles.

Base on the literature reviewed on CREDE, I determined that the CREDE model could mitigate the second limitation of learning preference congruent teaching by exposing students to a diverse range of instructional strategies. A CREDE classroom does this by requiring students to rotate through all the classroom's activity centers and complete each center's task (Doherty & Hilberg, 2007; Hilberg et al., 2003). These rotations offer many opportunities for students to complete a variety of tasks (Doherty & Hilberg, 2007; Hilberg et al., 2003), and if each of these tasks covers all the major course concepts in ways that accommodate the full spectrum of learning styles, all four of Kolb's (1984) learners, then the model would mitigate the second limitation, which is the lack of diversification in instructional strategies, by providing the diversification necessary to attain an optimal balance between learning preference congruent and non-congruent instructional strategies.

Regarding the second limitation of diversification in instructional strategies, which I found after reviewing the literature on learning preferences, the study results were only partially consistent with the expectation I made based on the literature reviewed related to CREDE. The study results showed that EDEP 201 was not successful in attaining an optimal balance between learning preference congruent and non-congruent instructional strategies. While EDEP 201 provided some diversification of instructional strategies, the course did not reach a level at which the second limitation was fully mitigated. In order to fully mitigate the second limitation of

diversification in instructional strategies, center tasks must cover each of the major class concepts in ways that accommodate all the learning styles present in class. In EDEP 201, there were four major course concepts and four regularly conducted center tasks each of which accommodated one of the four learning styles defined by Kolb (1984). Therefore, if each of these regularly conducted center tasks had covered the course's four major concepts, then EDEP 201 would have provided enough diversification to achieve an optimal balance between learning preference congruent and non-congruent instructional strategies.

However, among the four center tasks regularly conducted in EDEP 201, all the center tasks except for one did not cover all the course's major concepts. The course's major concepts were Korthagen's (2004) Onion Model, core qualities, the CREDE Five Standards, and the COR (Luning et al., 2011). The Final Word task that accommodated diverging learners mostly dealt with core qualities and Korthagen's Onion Model. The core quality application task that appealed to accommodators also exclusively dealt with core qualities and Korthagen's Onion Model. The CREDE application task that accommodated converging learners only dealt with the CREDE Five Standards and the COR. Among the center tasks used in EDEP 201, the discussion paper task was the only one that covered all of the course's major concepts.

Unlike the discussion paper task, the other center tasks regularly conducted in EDEP 201 covered only some of the major course concepts. If all of these tasks had covered all the major course concepts, then the rotation inherent in the CREDE classroom design would have guaranteed that an optimal balance between learning preference congruent and non-congruent instructional strategies would have been achieved. In this case, the rotation would have provided an optimal balance of instruction strategies because all the participants would have been exposed to all of the major course concepts in ways that were not congruent with their learning

preferences as well as ways that were congruent with their learning preferences. However, since this was not the case in EDEP 201, when learning preference congruent instruction was not the most effective way for students to learn certain major course concepts, exposure to the more effective instructional method was possible for some learners but was not guaranteed for all learners. In conclusion, while EDEP 201 provided some diversification of instruction strategies, the course did not fully mitigate the second limitation of learning preference congruent teaching.

### **Limitations**

Even though all 16 students in EDEP 201 volunteered to be participants in my study, the sample size was still small. With a larger sample size, I might have found more variations in the responses of those who had the same learning style, as well as those who had different learning styles, which might have altered the study conclusions.

A limitation related to my classroom observations was that compared to the time I spent in class, I found only a couple of general themes through observations. Since three to four center tasks were simultaneously conducted in EDEP 201, and the members of each center changed every time the students rotated from one center to another, I was not able to observe and take notes on all the participants' interactions at all the activity centers that were conducted each class period. If this was possible, I might have found more patterns and themes in the data collected through classroom observations. In addition, since I was the only one who observed the participants, my biases concerning learning preferences might have colored my observations of the participants.

Furthermore, during the individual interviews, some participants were hesitant to discuss the center tasks, which they found to be less helpful, engaging, and/or enjoyable. This could be



because they were concerned that I worked with their course instructor and their responses might have affected their relationship with their instructor or their grades.

Additionally, near the end of the individual interviews, the LSI results were revealed to the participants. Therefore, the responses of the participants in the subsequent interviews of this study may have been affected by this knowledge.

The last limitation is regarding one of the themes that emerged from the focus group interviews. I found that when participants with different learning styles worked together, there was more interaction and less agreement compared to when participants with the same learning style worked together. I found this theme from the focus group interviews by purposefully grouping the students according to learning style. However, the main topic of the discussions during the focus group interviews was learning preferences. If the participants had discussed topics other than learning preferences, different findings might have emerged.

### **Future Research**

Future researchers can use a larger sample size, which may help them find more variations in the responses of those who had the same learning style, as well as those who had different learning styles. This may lead future researchers to reach different conclusions. Furthermore, future researchers can conduct similar studies using other CREDE courses that teach something different from EDEP 201, like statistics. Future researchers may find a different ratio of Kolb's learning styles in those courses because different courses may attract different types of learners (Severiens & Dam, 2007; Shein & Chiou, 2011).

Future researchers can also use additional observers in order to reduce the extent that any one researcher's bias may affect the study. Furthermore, future researchers can better utilize technology when collecting data in that they can audiotape or videotape the simultaneously

conducted activities in a CREDE classroom. This will allow them to collect more data on the interactions of participants when multiple activities are conducted at the same time, and these additional data may uncover new and more specific themes.

In addition, future researchers should not reveal the LSI results of their participants until the study ends. This would avoid the possibility of their participants developing biases for or against their learning styles, which may affect their responses and behaviors.

Another suggestion for future research is that researchers can regularly group students with different learning styles together and instruct them to complete center tasks on various topics. Future researchers can also regularly group students with the same learning style together, and instruct them to complete tasks comparable to their mixed group counterparts. By doing this on a regular basis, future researchers may find new similarities and differences in peer interaction among those who had the same learning style and those who had different learning styles. They may also find instances in which either one of these groupings works better to promote student engagement and/or assist students in understanding class concepts.

Furthermore, future researchers can explore ways to adapt the CREDE classroom design, so that it fully tempers the second limitation of diversification in instructional strategies. In order to provide the diversification necessary to attain an optimal balance between learning preference congruent and non-congruent instructional strategies, future researchers can design center tasks that cover each of the major class concepts in ways that accommodate all the learning styles present in class. In order to do this, it is important to take into consideration the number of learning styles, the number of major course concepts, and the number of regularly conducted center tasks present in class. There are many ways in which a classroom can be organized in order to temper the second limitation of diversification in instructional strategies. However, as

long as each of the major class concepts is covered in ways that accommodate all the learning styles present, an optimal balance between learning preference congruent and non-congruent instructional strategies will be achieved.

The final suggestion for future research is about investigating the relationship between learning preference congruent teaching and learning outcomes. This was beyond the scope of the current study. The scope of this study did not include the participants' learning outcomes because it examined the extent to which the CREDE model could facilitate learning preference congruent teaching. Since no studies concluded that the CREDE model facilitates learning preference congruent teaching and EDEP 201 was not designed to accommodate learning styles, measuring the participants' learning outcomes would only be related to the effectiveness of the CREDE model, which was already supported by past research.

It would only be possible to investigate the relationship between learning preference congruent teaching and students' learning outcomes in a classroom design that facilitates learning preference congruent teaching while successfully tempering the two limitations of practicality and diversification in instructional strategies. In order for a CREDE classroom to accomplish this, it has to be intentionally designed to accommodate learning preferences. To this point, it is necessary for future researchers to use learning profiles to design center tasks that accommodate different types of learning styles and ensure that the tasks cover each of the major concepts in ways that accommodate all the learning styles present in the group of learners they use in their study.

Once learning preference congruent teaching is fully integrated into the CREDE model, the scope of future research can be expanded to include students' learning outcomes. Future researchers can examine how learning preference congruent teaching works with the CREDE

model to affect students' learning outcomes by comparing students' learning outcomes in a regular CREDE classroom to a CREDE classroom that facilitates learning preference congruent teaching while successfully tempering the two limitations.

### **Implications for Practice**

The study results demonstrated that each of the participants had preferred learning modes and a preferred learning style, and participants who had the same learning style generally preferred the same center tasks. Furthermore, the results showed that there was a positive relationship between the center tasks that the participants stated accommodated their learning preferences and the center tasks they found to be more enjoyable, helpful, and engaging. The implication that can be derived from these results is that educators may increase students' perceptions of how helpful, engaging, and enjoyable class activities are by ensuring that class activities accommodate students' learning styles. Therefore, it is important for educators to know their students' learning styles and design class activities that accommodate their students' learning styles.

In addition, the study results showed that EDEP 201 was able to temper the first limitation of practicality because the class used various types of simultaneously conducted activity center tasks, which accommodated different learning styles. The implication that can be derived from these results is that educators may make learning preference congruent teaching feasible within the time constraints of an average class session by running simultaneously conducted activity center tasks.

Furthermore, the study results demonstrated that when participants with different learning styles worked together to complete center tasks, there was more interaction and less agreement among them compared to when participants with the same learning style worked together. The

implication that can be derived from these results is that educators may increase student interaction during class activities by grouping students with different learning styles together.

Additionally, the study results showed that most of the accommodating learners in EDEP 201 tended to take the initiative, talk at higher rates than others, dominate the conversations, change the topics of discussions, and/or lead the discussions. The implication that can be derived from these results is that educators may increase the equity of student participation by encouraging students to reflect upon the strengths and weaknesses of their learning styles. Educators can also provide their students with opportunities to discuss how to increase the equity of class participation. Through reflecting upon their learning styles and discussing how to increase the equity of class participation, accommodators may try to speak less and listen to their group members more often. According to Alagappan and Ramayan (2007), by understanding their learning styles, students become more in control of their learning processes, and they become more responsible learners.

Lastly, the study results showed that at the student-led centers, the students tended to only partially complete their assigned center tasks. In addition, the students at those centers tended to discuss the given topics in a broader context, and they eventually digressed from the intended topics. The implication that can be derived from these results is that educators may assist students in fully completing their assigned tasks and staying on topic longer at the student-led centers by providing them with checklists for student-led center tasks or some other product to be turned in after the student-led center tasks. Educators can also assign a facilitator in each group at the student-led centers, so these facilitators can ensure their group's discussions are on the right track and that all the items on the checklists are addressed. Additionally, educators can discuss topics like how good facilitators assist group discussions with students in order to create

a safe and positive learning environment where students respect one another's opinions and encourage everyone to participate.

**Appendix A**  
**The Classroom Observation Rubric (COR)**

<b>Standard</b>	<b>Not Observed (0)</b>	<b>Emerging (1)</b>	<b>Developing (2)</b>	<b>Advancing (3)</b>	<b>Enacting (4)</b>	<b>Exemplary (5)</b>
<p><b><i>Joint Productive Activity</i></b> (JPA)</p> <p><i>Definition:</i> <i>Teacher and students collaborating together</i></p>	Not observed	A small group of students contributes individual work (e.g., round robin reading or turn-taking), not requiring collaboration to a joint product*.	Students are collaborating* with a partner or assisting one another (without teacher involvement), OR the teacher and student collaborate on a product* in a whole-class or large group setting.	A small group of students collaborate* on a joint product*. Or the teacher and a small group of students work together, but there is minimal collaboration by the teacher or by the students (e.g., teacher is floating to assist students).	The teacher and a small group of students collaborate* on a joint product* for a sustained amount of time* (about 10 minutes or more). The majority of the students participate in the product's* creation. The teacher assists collaboration using multiple forms of assistance*.	The teacher and a small group of students collaborate* on a joint product* for a sustained amount of time* (about 10 minutes or more). The majority of the students participate in the product's* creation. The teacher assists collaboration using multiple forms of assistance*.
<p><b><i>Language &amp; Literacy Development</i></b> (LLD)</p> <p><i>Definition: Developing language across the curriculum</i></p>	Not observed	The teacher designs and enacts an instructional activity where students engage in brief, repetitive, or drill-like reading, writing, or speaking activities (e.g., worksheets, round robin reading, flashcards, etc.).	The teacher a) models appropriate language use highlighting vocabulary or ways of speaking and/or writing appropriate for the content area AND/OR b) provides opportunities for students to use academic language.	The teacher designs and enacts an instructional activity where one of the academic goals* is to generate language expression and/or literacy development. These activities are designed as sustained reading, writing, OR speaking activities. The teacher provides assistance towards language expression and/or literacy development.	The teacher designs and enacts an instructional activity where one of the academic goals* is to generate language expression and/or literacy development. These activities are designed as sustained reading, writing, OR speaking activities. The teacher provides extended assistance* towards language expression and/or literacy development.	The teacher designs and enacts an instructional activity with a clear academic goal* of generating language expression and/or literacy development. These activities are designed with a focus on developing discourse* within the content area. The teacher provides extended assistance* towards language expression and/or literacy development.

Standard	Not Observed (0)	Emerging (1)	Developing (2)	Advancing (3)	Enacting (4)	Exemplary (5)
<p style="text-align: center;"><b>Contextualization (CTX)</b></p> <p style="text-align: center;"><i>Definition: Making meaningful connections</i></p>	Not observed	The teacher (a) connects classroom activities by theme or builds on the current unit of instruction, OR (b) reviews previous academic content, OR (c) connects to prior school knowledge, OR (d) uses materials that are familiar to students from their everyday experiences.	The teacher (a) includes some aspect of students' everyday experience in instruction through incidental* connections OR (b) responds to an incidental connection made by students OR (c) the activity makes connections to the student or his/her home and community contexts.	The teacher designs and enacts instructional activities that integrates* knowledge of what students know from their home, community, or school contexts (not <i>just</i> building on current unit of instruction) AND has students consider how the academic content and their experiences are related.	The teacher designs and enacts instructional activities that integrates* knowledge of what students know from their home, community, or school (not <i>just</i> building on current unit of instruction). The teacher assesses and assists students in making an academic connection to their experiences.	The teacher designs and enacts instructional activities that integrates* knowledge of what students know from their home, community, or school (not <i>just</i> building on current unit of instruction). The teacher assesses and assists students in making an academic connection to their experiences with a clear goal helping students to reach a conceptual/ abstract understanding.
<p style="text-align: center;"><b>Complex Thinking (CT)</b></p> <p style="text-align: center;"><i>Definition: The elevation of students' thinking to higher levels</i></p>	Not observed	The teacher designs activities that engage students in reviewing or recalling information. Students work independently from the teacher.	The teacher designs instructional activities that include complex thinking*. The teacher provides assistance towards task completion.	The teacher designs instructional activities that include complex thinking*. The teacher provides assistance towards task completion while assisting with concept development*.	The teacher designs and enacts instructional activities and assists students as they use complex thinking* strategies. The teacher's focus is on concept development* using probing techniques with the goal of advancing students' thinking to higher levels.	The teacher designs and enacts instructional activities and assists students as they use complex thinking* strategies. The teacher's focus is on concept development.* The assess-assist-assess cycle is used to uncover the <i>why</i> of the activity and reach a conceptual/abstract understanding.



Standard	Not Observed (0)	Emerging (1)	Developing (2)	Advancing (3)	Enacting (4)	Exemplary (5)
<p data-bbox="121 708 327 821"><b><i>Instructional Conversation (IC)</i></b></p> <p data-bbox="92 1078 352 1170"><i>Definition: Small group discussion on an academic topic.</i></p>	Not observed	The teacher converses* with a large group of students on an academic topic for a sustained amount of time* AND elicits student talk with questioning, listening, rephrasing, or modeling.	The teacher converses* with a small group of students on an academic topic for a sustained amount of time* AND elicits student talk with questioning, listening, rephrasing, or modeling.	The teacher designs and enacts an instructional conversation (IC)* with a small group of students with a clear academic goal* for a sustained amount of time* AND listens carefully to assess and assist student understanding.	The teacher designs and enacts an instructional conversation (IC)* with a small group of students with a clear academic goal* for a sustained amount of time*; listens carefully to assess and assist student understanding AND questions students on their views*, judgments or rationales in reaching the academic goal.	<p data-bbox="1759 521 2018 976">The teacher designs and enacts an instructional conversation (IC)* with a small group of students with a clear academic goal* for a sustained amount of time*; listens carefully to assess and assist student understanding AND questions students on their views*, judgments or rationales in reaching the academic goal.</p> <p data-bbox="1759 1016 2018 1162">The teacher facilitates the conversation so that student talk occurs at a higher rate than teacher talk.</p>

## Glossary of Terms

**Academic Goal:** A projected or desired endpoint in understanding. Academic goals typically come from local or national educational standards, or as sub-sets of these.

**Assess-Assist-Assess Cycle:** This cycle begins with the teacher (a) assessing what his/her students know, understand, or can do related to a specific goal/objective, (b) assisting students in reaching a new understanding through questioning, feedback, modeling, instruction, etc. and then, (c) assessing students' comments for a change in their understanding. If the students have not grasped what the teacher intended them to learn, the teacher engages in the cycle again using alternative methods of assistance. This cycle is achieved when the students effectively achieve the teacher's intended goal.

**Assistance:** Types of assistance may include: (a) Modeling -- Providing a demonstration; (b) Feeding Back -- Providing information about student performance as compared with a standard; (c) Contingency Management: -- Providing rewards or punishments contingent on student performance; (d) Questioning -- Providing questions that guide students to advance their understanding; (e) Instructions -- Providing clear verbal directions for performance; (f) Cognitive Structuring -- Providing explanations or rules for proceeding; or (g) Sequencing -- Providing assistance by segmenting or sequencing portions of the task.

**Collaboration:** Joint activity that results in shared ownership, authorship, use, or responsibility for a product. It can also include division of labor for coordinated sub-sections. However, mere turn taking does not constitute division of labor and, to be considered collaboration, an activity must include interaction between participants. For example: collaboration on an intangible product could be a collective process of comprehension and building of understanding.

**Complex Thinking-Activities that advance student understanding to more complex levels:** (a) the 'why' is addressed, not merely the 'what' or the 'how to'; (b) the activity requires that students generate knowledge, or *use* or *elaborate* on information provided (apply, interpret, categorize, order, evaluate, summarize, synthesize, analyze, explore, experiment, determine cause and effect, formulate and solve problems, explore patterns, make conjectures, generalize, justify, make judgments); (c) the teacher connects the content or activity to a broader concept or abstract idea to advance student understanding; or (d) the teacher provides instruction in critical thinking, or problem solving or meta-cognitive strategies.

**Concept Development:** Concepts include abstract or theoretical understanding. In some subject areas, concept development may include skill based activities.

**Conversation:** At least two turn taking cycles (teacher-student-teacher-student on the same topic/point).

**Discourse:** A conversation that provides opportunities for students' to learn the ways of thinking and speaking about a subject area.

**Extended Assistance:** The teacher provides responsive assistance that goes beyond vocabulary building. The focus of the assistance is on developing students' language and literacy through discussion. Extended assistance typically requires that multiple forms of assistance be used.

**Instructional Conversation (IC):** ICs are inclusive of all participants whose contributions are connected to, or extend, the comments and ideas of other participants. In contrast, directed-discussions focus less on developing conceptual understanding and more on known-answer questions and skill development. Instructional conversation focuses on broad topics, main ideas, themes or concepts, is responsive to students' contributions.

**Incidental connections:** The teacher (a) makes connections between students' experience or knowledge from home, school, or community (prior knowledge) and the new activity/information on an ad hoc basis to assist understanding, or (b) prompts students to make connections.

**Integrated connections:** (a) students' knowledge or experience is integrated with new information, (b) the basis of the activity is personally relevant to students' lives (based on prior knowledge); or (c) students apply school knowledge in an authentic activity.

**Product:** Products may be tangible or intangible. Examples of tangible products: worksheet, essay, report, pottery, word-web, a math problem solved on the blackboard, play, skit, game, and debate. Intangible products may be found in such activities as 'story time,' introductory lectures, or some ICs (the product is an accurate or elaborated understanding of a concept, procedure, idea), or some PE activities (increased physical fitness is the product, though not joint). The intangible products are an achieved physical, psychological, or social state that integrates a series of actions.

**Students' views (question students on their views):** In an Instructional Conversation, questioning students on their views is inclusive of students' prior knowledge or experience related to the goal of the conversation.

**Sustained amount of time:** The teacher is engaged with the students for about 10 minutes or more. The approximate time of around 10 minutes is to allow enough time for quality collaboration, conversation, and assistance. However, this level of quality may occur at less than 10 minutes.

## Appendix B

### The Learning Style Inventory (LSI)

The Learning-Style Inventory describes the way you learn and how you deal with ideas and day-to-day situations in your life. Below are 12 sentences with a choice of endings. Rank the endings for each sentence according to how well you think each one fits with how you would go about learning something. Try to recall some recent situations where you had to learn something new, perhaps in your job or at school. Then, using the spaces provided, rank a "4" for the sentence ending that describes how you learn *best*, down to a "1" for the sentence ending that seems least like the way you learn. Be sure to rank all the endings for each sentence unit. Please do not make ties.

**Example of completed sentence set:**

1. When I learn:      2 I am happy.      1 I am fast.      3 I am logical.      4 I am careful.

**Remember:** 4 = *most* like you    3 = *second most* like you    2 = *third most* like you    1 = *least* like you

	A	B	C	D
1. When I learn:	___ I like to deal with my feelings.	___ I like to think about ideas.	___ I like to be doing things.	___ I like to watch and listen.
2. I learn best when:	___ I listen and watch carefully.	___ I rely on logical thinking.	___ I trust my hunches and feelings.	___ I work hard to get things done.
3. When I am learning:	___ I tend to reason things out.	___ I am responsible about things.	___ I am quiet and reserved.	___ I have strong feelings and reactions.
4. I learn by:	___ feeling.	___ doing.	___ watching.	___ thinking.
5. When I learn:	___ I am open to new experiences.	___ I look at all sides of issues.	___ I like to analyze things, break them down into their parts.	___ I like to try things out.
6. When I am learning:	___ I am an observing person.	___ I am an active person.	___ I am an intuitive person.	___ I am a logical person.
7. I learn best from:	___ observation.	___ personal relationships.	___ rational theories.	___ a chance to try out and practice.
8. When I learn:	___ I like to see results from my work.	___ I like ideas and theories.	___ I take my time before acting.	___ I feel personally involved in things.
9. I learn best when:	___ I rely on my observations.	___ I rely on my feelings.	___ I can try things out for myself.	___ I rely on my ideas.
10. When I am learning:	___ I am a reserved person.	___ I am an accepting person.	___ I am a responsible person.	___ I am a rational person.
11. When I learn:	___ I get involved.	___ I like to observe.	___ I evaluate things.	___ I like to be active.
12. I learn best when:	___ I analyze ideas.	___ I am receptive and open-minded.	___ I am careful.	___ I am practical.

## **Appendix C Learning Profiles**

### **Learning Profile for Assimilators**

Assimilating learners process information by watching rather than doing. In other words, these learners are found in the portion of the processing continuum of Kolb's (1984) model that is designated as the reflective observation mode, which is also called the watching mode.

Assimilating learners are good at looking at things from different perspectives and appreciate different points of view. They focus on understanding the meaning of ideas rather than focusing on how to practically apply them. They also focus on reflection rather than action and value patience as well as thoughtful judgment. Furthermore, assimilating learners perceive information by thinking rather than feeling. In other words, these learners are found in the portion of the perceiving information continuum of Kolb's model that is designated as the abstract conceptualization mode, which is also called the thinking mode. Assimilating learners emphasize thinking rather than feeling, and they focus on using ideas, logic, and concepts. They are concerned with building general theories as opposed to understanding unique and specific areas. Assimilating learners prefer a scientific rather than artistic approach to problem solving. They are good at systematic planning and quantitative analysis. Lastly, assimilating learners value precision, discipline, and a well-structured system when analyzing ideas.

Assimilating learners focus on ideas and abstract concepts rather than people. They value ideas that are theoretically logical and precise over ideas that have practical use. Assimilating learners are good at generating theory by assimilating all observations. In other words, they prefer to utilize inductive reasoning. Those who have these learning characteristics are frequently found in the basic sciences, and mathematics rather than the applied sciences. Many researchers share these characteristics.

## **Learning Profile for Convergers**

Converging learners process information by doing rather than watching. In other words, these learners are found in the portion of the processing continuum of Kolb's (1984) model that is designated as the active experimentation mode, which is also called the doing mode. Converging learners focus on doing rather than on observing. They emphasize practical application and pragmatic concerns. Converging learners focus on actively influencing the environment and people around them. They are willing to take some risks to achieve their objectives, and they like to see results. Furthermore, converging learners perceive information by thinking rather than feeling. In other words, these learners are found in the portion of the perceiving continuum of Kolb's model that is designated as the abstract conceptualization mode, which is also called the thinking mode. Converging learners emphasize thinking rather than feeling, and they focus on using ideas, logic, and concepts. They are concerned with building general theories as opposed to understanding unique and specific areas. Converging learners prefer a scientific rather than artistic approach to problem solving. They are good at systematic planning and quantitative analysis. Lastly, converging learners value precision, discipline, and a well-structured system when analyzing ideas.

Converging learners tend to cultivate a practical understanding of theory and seek out ways to apply theory to real world situations. They are good at problem solving and decision making. Converging learners prefer using deductive reasoning, and they function well in situations where there is a single correct answer or solution to a question or problem. They also prefer dealing with technical tasks rather than social and interpersonal issues. Converging learners are often found in the physical sciences. Many engineers and technical specialists commonly have these characteristics.

## **Learning Profile for Divergers**

Diverging learners process information by watching rather than doing. In other words, these learners are found in the portion of the processing information continuum of Kolb's (1984) model that is designated as the reflective observation mode, which is also called the watching mode. Diverging learners are good at looking at things from different perspectives and appreciate different points of view. They focus on understanding the meaning of ideas rather than focusing on how to practically apply them. They also focus on reflection rather than action and value patience as well as thoughtful judgment. Furthermore, diverging learners perceive information by feeling rather than thinking. In other words, these learners are found in the portion of the perceiving continuum of Kolb's (1984) model that is designated as the concrete experience mode, which is also called the feeling mode. Diverging learners focus on the uniqueness and complexity of reality rather than theory. In other words, they like ideas to be connected to real situations, so they can contextualize ideas in terms of personal experience. They prefer an intuitive and artistic approach to problem solving rather than a systematic scientific approach. Diverging learners function well in unstructured situations, and they tend to be good intuitive decision makers. They enjoy and are good at relating to people.

Diverging learners tend to be imaginative and feeling oriented. They are interested in people, so they prefer activities like cooperative group work. They also have broad cultural interests. They perform well in freethinking situations, such as brainstorming. Many diverging learners go into the fields of humanities and liberal arts. Counselors and personal managers usually have these characteristics.

## **Learning Profile for Accommodators**

Accommodating learners process information by doing rather than watching. In other words, these learners are found in the portion of the processing information continuum of Kolb's (1984) model that is designated as the active experimentation mode, which is also called the doing mode. Accommodating learners focus on doing rather than on observing. They emphasize practical application and pragmatic concerns. Accommodating learners focus on actively influencing the environment and people around them. Furthermore, accommodating learners perceive information by feeling rather than thinking. In other words, these learners are found in the portion of the perceiving continuum of Kolb's model that is designated as the concrete experience mode, which is also called the feeling mode. Accommodating learners focus on the uniqueness and complexity of reality rather than theory. In other words, they like ideas to be connected to real situations, so they can contextualize ideas in terms of personal experience. They prefer an intuitive and artistic approach to problem solving rather than a systematic scientific approach. Accommodating learners function well in unstructured situations, and they tend to be good intuitive decision makers. They enjoy and are good at relating to people.

Accommodating learners are action-oriented and enjoy carrying out tasks. They are good at adapting themselves to changing circumstances, and they tend to solve problems in an intuitive trial and error manner. Accommodating learners rely on other people for information rather than on their own analytic ability. They are comfortable with people but sometimes appear impatient and pushy. People in the fields of business, marketing, sales, and management tend to have these characteristics.



## **Appendix D**

### **Interview Questions**

1. How does your overall learning experience in a CREDE classroom that uses small group activities compared to your learning experience in similar classes you have taken that did not use small group activities?
  - 1-1. Which type of class (CREDE or lecture-centered) do you prefer? Why?
  - 1-2. Which type of class do you think better assisted you in understanding the concepts presented? Why?
2. How would you compare your classes that have used small group activities to the CREDE classroom's use of small group activities?
3. Which activity center task(s) did you enjoy more? Why?
4. Which activity center task(s) do you think better assisted you in understanding the concepts presented? How did they assist you?
5. Which activity center task(s) was (were) less enjoyable? Why?
6. Which activity center task(s) do you think did not assist you or assisted you less in understanding the concepts presented? What improvements in that (those) center task(s) could be made to better assist you in understanding the concepts presented?
7. Which activity center task(s) was (were) more engaging? What made you become more engaged in that (those) activity center task(s)?
8. Which activity center task(s) was (were) less engaging? What lessened your engagement in that (those) activity center task(s)?
9. Do you have any suggestions for improving activity center tasks?
10. Do you think your LSI results, including the learning style, reflect your learning preferences? Please explain why.

11. Which activity center task(s) accommodated your learning preferences? How did that (those) center task(s) accommodate your learning preferences?

12. Which activity center task(s) did not accommodate your learning preferences? What improvements in that (those) center task(s) could be made to better accommodate your learning preferences?

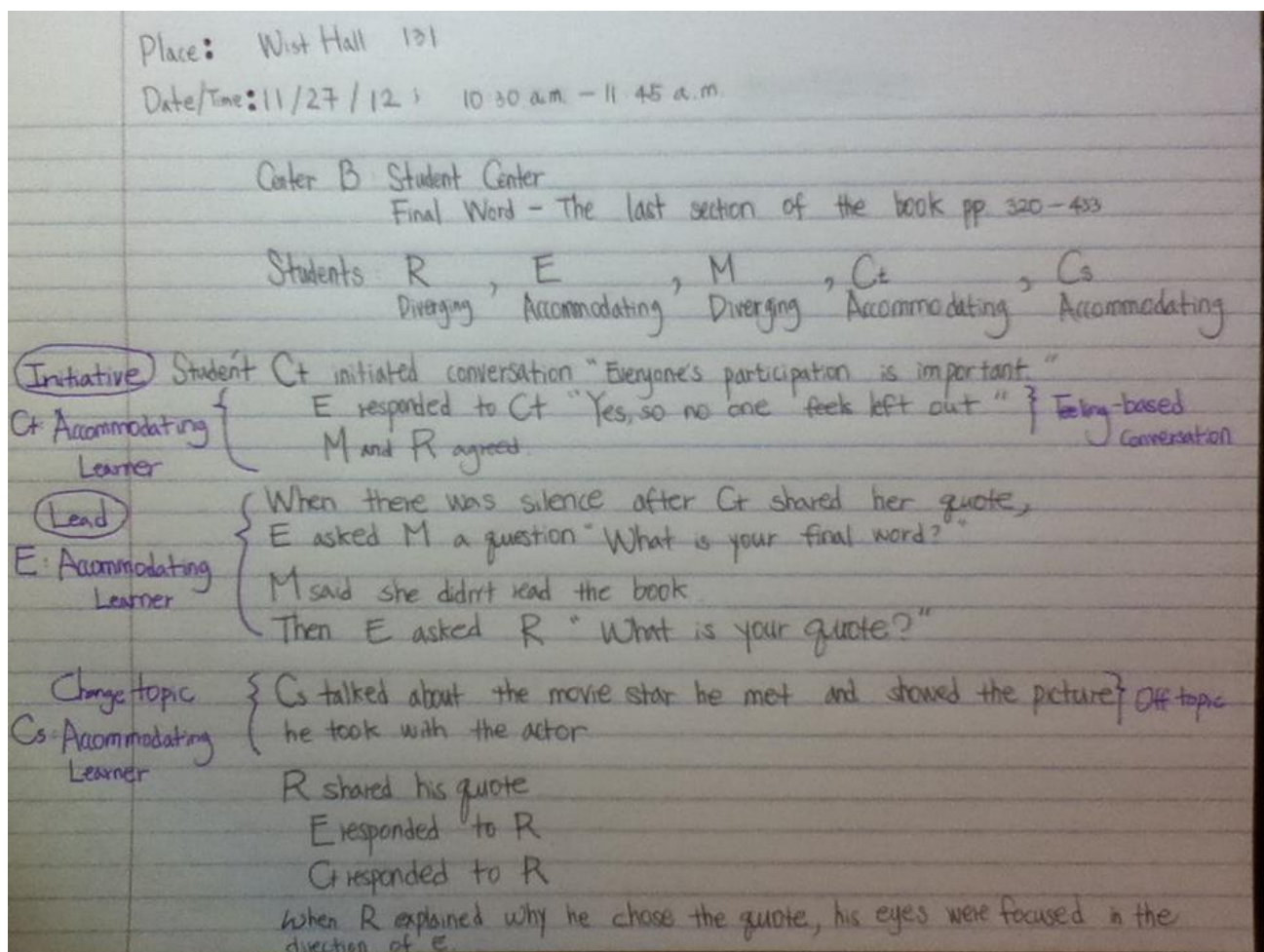
13. Do you have any suggestions for improving activity center tasks to better accommodate your learning preferences?

14. Do you think your learning preferences were accommodated on a regular basis in class?

Please explain why.

## Appendix E

### An Example of Field Notes with Codes



**Appendix F**  
**An Example of Individual Interview Transcripts with Codes**

Date: 10/11/12

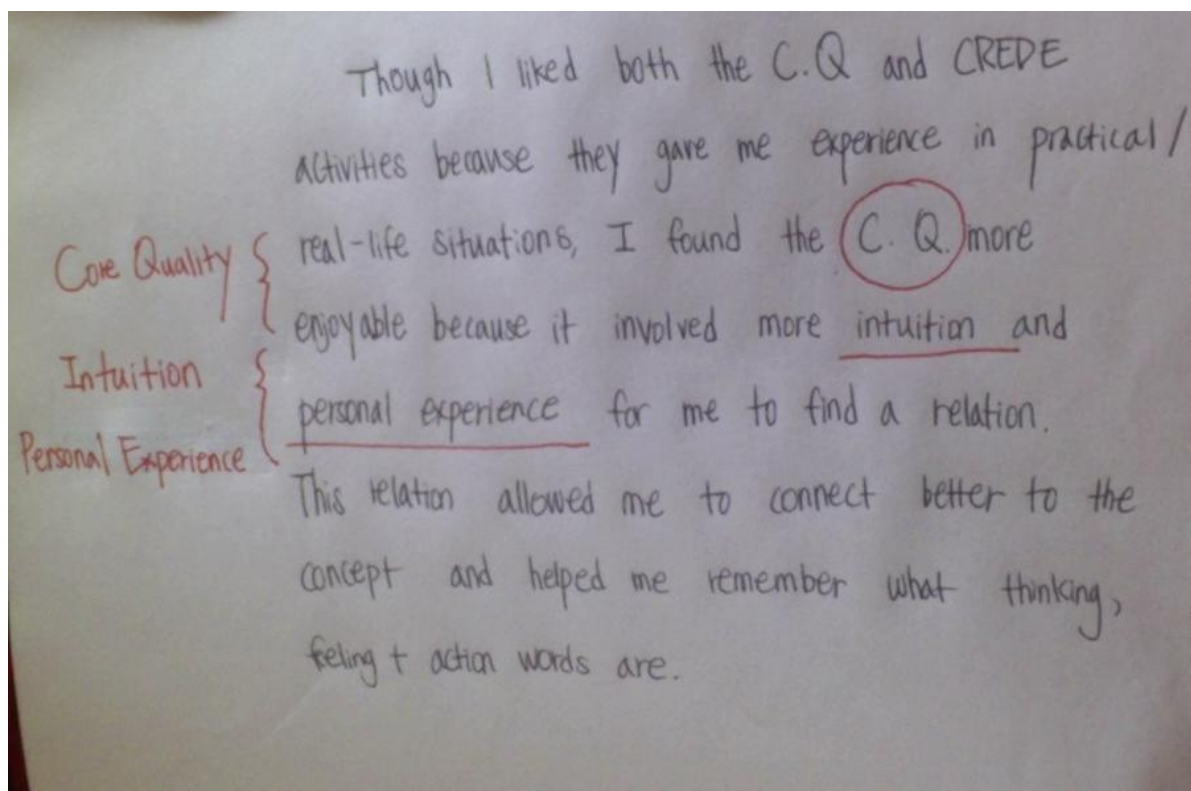
Time: 9:30 a.m. - 10:00 a.m.

Interviewee: Student A: Diverging Learner (The Feeling Mode + The Watching Mode)

Reflect: I think they [my LSI results] do reflect my learning preferences. I think a lot of them reflect my learning preferences. I am sensitive to other people's feelings. I am feeling-oriented. I am really empathetic. I like to listen to other people. I appreciate other people's perspectives and they're interesting. I adapt [how I learn] by observation rather than by action. I like to sit back and watch people or observe rather than actually taking part in something.

Not Reflect: Imaginative and innovative? I don't think of myself as imaginative or innovative. I don't think I have a big imagination. I don't really have much of an imagination.

**Appendix G**  
**A Sample of a Participant's Free Writing Assignment with Codes**



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