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Learning Styles: Teaching Technology Subjects Can Be More Effective

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Learning style theory has been developed and applied in various curricula for all levels of education. Kolb (1985) developed one particular method of assessing student learning style. The use of this method has been documented in the engineering and technology programs of several universities. Variations in learning style due to cultural diversity have been studied and are described in the literature.

This article describes and recommends the use of learning style theory to assess individual learning styles in the classroom and the use of teaching methods to accommodate various learning styles. Sutliff (one of the authors) administered the Learning Style Inventory (LSI) to his computer-aided drafting class in the School of Technology at Eastern Illinois University. Results of this study are offered here, as well as examples drawn from the literature, to show the potential helpfulness of this process in accommodating the various learning styles of students of engineering and technology, including those that result from cultural diversity.

The Teacher/Learner Relationship

Miller and Rose (1975), two prominent vocational-technical teacher educators, insisted that two truths must be recognized in class: all students differ and the teacher is often unaware of how they differ. The professional teacher should consistently observe students, listen to students, and try to understand each student. Personal differences of students need to be considered and the instructional delivery system needs to correspond to the varying abilities of the students. Bartel (1976) insisted that regardless of the teacher's abilities, including being an expert in their technical field, failure to learn will occur unless an understanding of the personal differences among students is known and teaching proceeds accordingly.

Kirkpatrick (1983) offered a three-step model to make teachers' presentations more meaningful: (a) present the material, (b) personalize the material, and (c) allow the students to interact with the material. If the material is just presented without an attempt to personalize it and have students interact with it, there is a strong possibility that the material presented will not be understood by the students. Students may not grasp the material even though it is well organized, technically adroit, and replete with creative visual aids.

Belay (1992) also invites educators to view cultural differences as another opportunity to conceptualize the learners as unique persons. He cited a growing body of knowledge that suggests several differences between cultures in cognitive processing and problem solving.

Too often, the teacher tends to view the classroom as one bifurcated between teaching and learning. Students may fail to learn the material because the teacher's style of teaching does not match the learner's style of learning.

Models For Adapting Instruction

Green and Parker (1989) proposed a sophisticated conceptualization of the learner and suggested a model that could enable teachers to adequately adapt their instruction to the unique needs and behaviors of their students. The model was Kolb's (1984) experiential learning model. Developed and fostered by Kolb in 1984, this model was originally based on experiential learning theory that integrated the cognitive and socio-emotional factors in learning. Throughout the years, there have been some modifications and enhancements to the model since it was introduced (Cornwell & Manfredo, 1994).

Kolb's original model consisted of a cyclical process involving four stages (see Figure 1) that included (a) concrete experience (CE), (b) reflective observation (RO), (c) abstract conceptualization (AC), and (d) active experimentation (AE).

The concrete experience stage of the learning cycle stresses personal involvement with people in daily situations. In this stage, the learner tends to rely on feelings rather than on a systematic approach to situations. In a learning setting, the learner's ability to be open minded, flexible, and adaptable to change would be important. People in this stage of the cycle learn from feeling. The learner would learn from specific experiences relating to people and would be sensitive to their feelings. To accommodate this learning mode, the teacher would include personalized teaching activities.

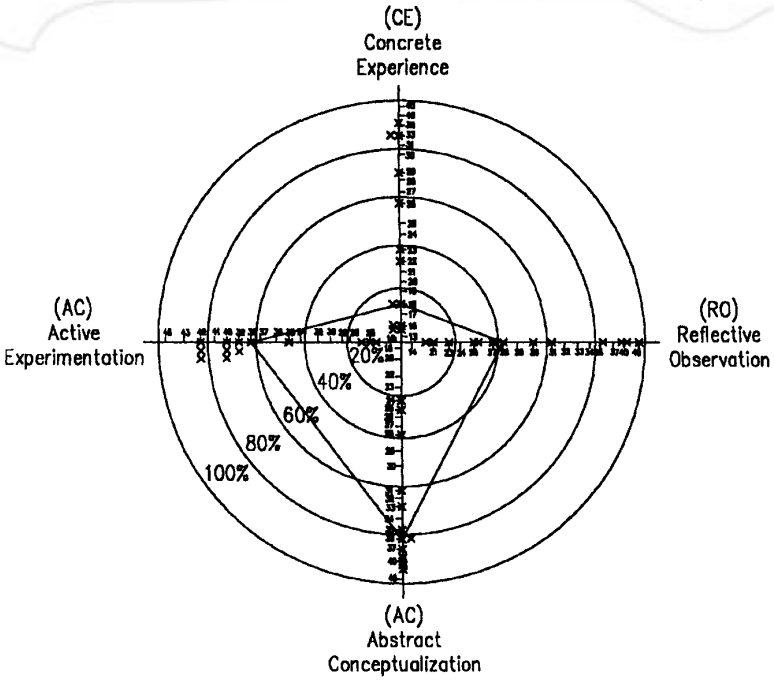

Figure 1. A student's learning style inventory scores are plotted on the diagram to get a "kite-like" shape.

In the reflective observation stage of the learning cycle, people group ideas and situations from differing perspectives. In a learning setting, the reflective observer would rely on patience, objectivity, and careful judgment. These learners depend on their own thoughts and feelings in creating their opinions. In other words, in this stage people learn by watching and listening. They would carefully observe before making decisions. They view issues from different points of views and look for the meaning of things. The learner in this stage needs to be provided with opportunities for reflective exercises.

In the abstract conceptualization stage a person's learning involves using logic and ideas, rather than feeling, to understand problems or situations. Typically, this learner relies on systematic planning and develops theories to solve problems. These people logically analyze ideas, systematically plan, and act on their intellectual understanding of a situation. This type of learner needs time to analyze the information presented.

In the active experimentation stage, learning involves experimenting, influencing, or changing a situation. Active experimenters take a practical approach and are concerned with what practically works rather than simply observing a situation. They value getting things done and seeing the results of their influence and creativity. This person learns by doing and has the ability to get things done. Active experimenters are definitely risk takers and influence people and events through action. To accommodate this mode in a learning situation, students are allowed many opportunities for "hands-on" activities. There is no single mode that completely describes a person's learning style. In reality, each person's learning style combines some, or all, of these learning modes (Kolb, 1985).

Optimally a teacher uses various types of learning strategies even if there is a dominant learning mode in class. Retention may be increased when a teacher addresses all learning modes. Stice (1987) found a similarity between the increased learning retention resulting from movement through all four stages of the learning cycle and the increased retention when auditory, visual, and kinesthetic methods of learning are employed together.

Kolb's model assumed that active experimentation (AE) and reflective observation (RO) are opposite modes and that abstract conceptualization (AC) and concrete experience (CE) are opposite modes (see Figure 2). By crossing or combining the four learning modes,

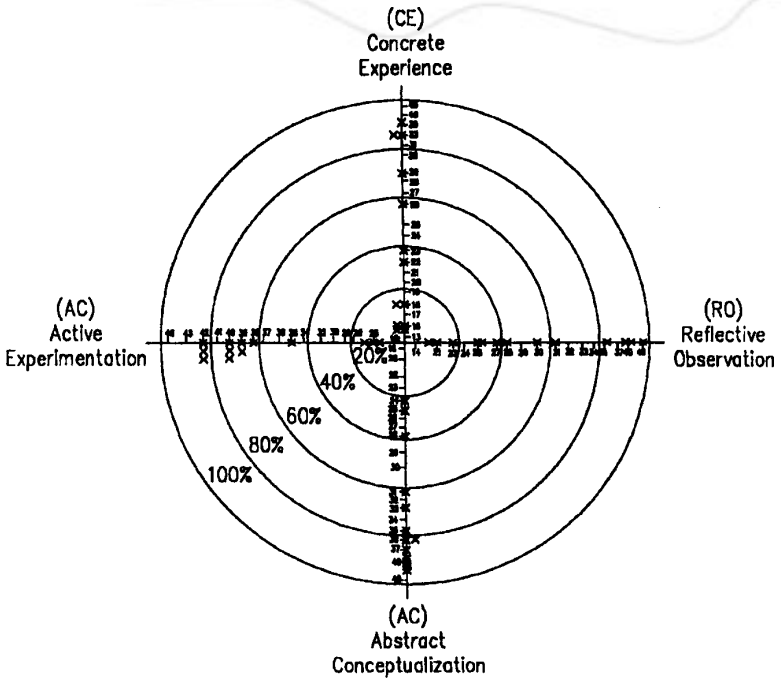

Figure 2. Plot of the scores of 13 students in a computer-aided drafting class.

four *learning style types* can be defined as follows:

- Accommodators—active experimentation combined with concrete experience.
- Convergers—active experimentation combined with abstract conceptualization.
- Assimilators—reflective observation combined with abstract conceptualization.
- Divergers—reflective observation combined with concrete experience (Kolb, 1985).

Kolb's Learning Style Inventory

The Learning Style Inventory (LSI) developed by Kolb (1985) is a test to help the learner and teacher understand the learner's predominant mode of learning. It consists of 12 questions, beginning with three or four words, for example, "When I learn…", "I learn best when…", and "I learn by…". Respondents rank four alternative endings to the words to best characterize their learning mode. There are no right or wrong answers, but rather what is perceived as "right" to the respondent.

When the learner finishes the inventory, his or her profile forms a "kite-like" shape. The shape and placement of the profile shows the respondent which learning mode(s) he or she tends to use the most (see Figure 1).

Students' scores on the Cycle of Learning compared with other student scores are also provided in the diagram. The raw scores for each of the four basic scores are listed on the perpendicular lines of the target. The concentric circles labeled with percentages represent percentile scores for the "normative group." The normative group score is a standard obtained by administering the test to many groups over time and getting an "average of the group averages." If a person scores 45% (i.e., 45th percentile), that would mean that 45% of the persons in the normative group scored lower. In comparison to the normative group, the shape of a person's profile indicates which of the four basic modes he or she tends to emphasize most.

Using The Learning Style Inventory In Class

In Felder and Silverman's (1988) article on using these techniques in class, they recommended talking to students about learning styles and how they learn best. We propose taking the process one step further by actually administrating the LSI to members of each class taught.

Teachers who administer the LSI in their classes can better understand each student's learning style and thus adjust their teaching style to maximize the potential achievement of the students. What is equally important is that the learner understands his or her own

Concrete Experiences
Small Group Discussion
Specific Examples
Trigger Videos
Practical Exercises
Simulations/Games
Personal Stories
Roll Playing

Active Experimentation
Case Studies
Fieldwork
Projects
Homework
Laboratories

Reflective Observation
Creative Problem Solving
Personal Journals
Discussion Groups
Brainstorming
Thought Questions
Reflective Papers
Observations

Abstract Conceptualization
Lectures
Papers
Analogies
Model Building
Theory Construction
Questioning

Figure 3. Instructional activities that support different aspects of the learning cycle (modified from Svinicki & Dixon, 1987, p. 142).

style of learning. This knowledge can increase their learning potential.

Sutliff administered the test to his junior level class of 13 computer-aided drafting students enrolled in an Industrial Technology program. The students were asked to read the instructions before starting the LSI and were allowed 10 minutes to complete the inventory. Then each student was instructed to total the four columns to get the scores for concrete experience (CE), reflective observation (RO), abstract concept (AC), and active experimentation (AE). After students totalled their scores, they plotted each score on the diagram, then connected the dots to get the kite shape. They were then informed that the shape and placement of the kite indicated which learning modes they tended toward. The entire process required 20 minutes.

Figure 2 plots the scores of 52 students. There are clusters of points outside the 60% circle for active experimentation (9) and abstract conceptualization (10). These represent 36.5% of the scores and indicate these two as the predominant learning modes in the class. The individual scores (not designated in this figure) show that only one student was very low in both modes. With that exception, all students would be accommodated if teaching methods were used that addressed the two dominant modes.

Figure 3 (modified from Svinicki & Dixon, 1987) lists sample activities that a teacher can assign or incorporate that support the different stages of the cycle of learning. Techniques for moving through the four stages during engineering class sessions can be found in the literature. For example, Harb, Durrant, and Terry (1993) found that accommmodator activities are typically lacking in engineering classrooms, especially in lower division courses. To accommodate the Kolb learning cycle, they offered samples from seven courses that typify an engineer's education (eg., materials, chemical engineering, manufacturing) that accommodate each of the four learning style types: accommodators, convergers, assimilators, and divergers. Howard, Carver, and Lane (1996) presented a lesson plan for a structured programming course to accommodate the Kolb learning cycle and other models.

When teachers become aware of students' variations and consider the extent to which each of these preferences exists in their classroom, they can plan instruction accordingly. None of the learning-style types—accommodators, divergers, convergers, or assimilators—is inherently superior. Rather, to be optimally effective, instructors need to work through each of the four stages and use

activities appropriate for each stage to accommodate all learning styles in the class. They also need to consider what is appropriate for the course content and the learning styles that dominate their classes. Use of all four stages during a classroom session, while taking more time, will enhance students' ability to learn independently and well.

Culture and Learning Styles

Guild (1994) examined the relationship between culture and learning style and concluded that the only way to meet the learning needs of culturally diverse students would be to intentionally apply diverse teaching strategies. In addressing the issue of structuring the basic public speaking course for African American students and other students of color, Nance and Foeman (1993) suggested including open discussion and physical movement as part of instruction to correspond to the unique learning styles of African American students. Belay (1992) and Correa and Tulbert (1991) described the learning styles that are typical of "field dependent" learners and that are attributed to certain cultures such as African Americans and Hispanics. With this style, learners tend to be more concerned with their social environment and prefer to work cooperatively with others. This type of learner may have serious adjustment problems in classes that emphasize lectures, competitiveness, and individualized work environments. Teachers who adopt methods that accommodate the variety of learning styles identified by Kolb will be addressing cultural differences in learning styles in the classroom simultaneously.

Powell and Andersen (1994) presented a model for adapting instruction to the learner that connects a person's culture to a particular learning style. In their essay on culture and classroom communication, they cited many examples of how students' cultural diversity influences instructional communication in the United States. The student from an Eastern culture tends toward reflective observation—since knowledge and insight in Eastern cultures are believed to come from reflection and meditation. On the other hand, the Native American student may combine reflective observation and active experimentation since the Native American culture tends to utilize a visual learning style that is dependent on observation and imitation, rather than explicit verbalization. In his study of the Israeli culture (with respect to the equivalency of Kolb's LSI), Katz (1988) stated that the Israeli culture is frequently characterized as aggressive, outspoken, energetic, and action oriented. The Israeli sample in his study displayed a more active experimentation orientation.

Balanced Delivery System

Kolb's model offers a system for teachers who are attempting to reach all students in their classrooms. In fact, this model can be institutionally adopted and used in the total instructional program of primary, secondary, and/or postsecondary schools to assure that all students are tested and to accommodate them personally while they are at school. The learning cycle and activities associated with the different modes definitely provide students with maximal learning and significantly reduce students' boredom and alienation. For example, teachers can lecture on the theory (abstract conceptualization); have students personally reflect on the content, ask questions, and discuss the content (reflective observation); assign homework, fieldwork, and laboratory projects (active experimentation); and direct small group discussions, give concrete examples, show videotapes, and discuss personal experiences (concrete experience). Through college curricular design, individual courses or sets of courses can take students through all four cycles.

It may not always be possible to have a completely "balanced" lesson, course, or program. The characteristics of the course often detemine which particular teaching style works well with the preferred learning styles of students. For example, a laboratory course more closely aligns with the concrete learning style. A course of study can begin with assessment of students' learning styles and follow with appropriate learning experiences to "fit the class."

Developing Learning Skills

Whether or not a teacher completely subscribes to this model is not as important as becoming aware of the mix of student learning styles in a classroom and the need to "fit" instruction to student need. Presumably, the primary goal of teachers is to maximize student achievement. Selecting and combining various teaching styles, as opposed to staying with the style the teacher prefers, is an important step

in meeting that goal.

According to Sugarman (1985):

> The capacity of Kolb's framework for helping people expand their repertoires of learning skills is also important. Students who are taught Kolb's ideas, both as the rationale for course design and as a model of the learning process, can conceptualize the total learning process, empathize more readily with the perspectives of students with different learning styles, and improve their own methods of learning. Although people may always prefer to learn through particular processes, they can develop their capacities in other fields. Thus, divergers can learn to give conscious attention to the applications of their observations and can realize the validity of doing so. Accommodators can reflect on their experiences and experiments. In other words, learning to learn can become an additional course objective. (p. 267)

The LSI can be used in a classroom setting to assess each student's learning style. Associated with each of the four stages of the cycle of learning are activities the teacher can use to meet both the course objectives and the instructional needs of their students. Doing so will also mitigate the learning style differences that are culturally derived as well as address the varied learning styles of students in a technical or technology program.

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