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Author: Thomson, Barbara S. - Mascazine, John R.
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We all have our own ways of doing things, from washing dishes to planning a trip. The preferences, tendencies, and strategies that individuals exhibit while learning constitute what have come to be called "learning styles." Formal study of learning styles has developed over the past 30 years from a variety of conceptual orientations. Among the theories of learning styles, that of Dunn and Dunn (1978) is among the most comprehensive in scope and practice for teachers. (DeBello, 1990)

THE DUNN MODEL

The model of learning styles created by Dunn, Dunn & Price (1979, 1980, 1990) comprises five major categories called "stimuli." Within these five major categories are 21 different elements that influence our learning. Following are the five types of stimuli and the elements they comprise:
*"Environmental" includes: light, sound, temperature, and room design.

*"Emotional" includes: structured planning, persistence, motivation, and responsibility.

*"Sociological" includes: pairs, peers, adults, self, group, and varied.

*"Physical" includes: perceptual strengths, mobility, intake, and time of day.

*"Psychological" includes: global/analytic, impulsive/reflective, and right- or left-brain dominance.

As each of us develops and accumulates experiences, we each come to rely on some of the elements more than others. For most individuals, four or five of the elements become extremely important when attempting to learn new or difficult information. Giving attention to the elements that most influence a person's learning is what constitutes attending to one's individual learning style.

APPLICATIONS OF THE DUNN MODEL TO MATHEMATICS AND

SCIENCE EDUCATION:Apart from administering individual Learning Style Instruments for each student and analyzing the results to find strengths and preferences, teachers can attend to individual differences by being attentive to individual stimuli and elements that influence learning. One way to do this is to focus on a particular stimuli or element of the model.

Consider the environmental stimuli. Attention to the classroom learning environment may include changing the physical layout of the room, allowing for seating changes with regard to light from natural or bright light (near windows), or to softly lit areas. Temperature differences may also be addressed with careful seat arrangements or placement of fans. Some classrooms lend themselves to greater flexibility than others, allowing space for some assignments to be completed at large tables or on the floor. Temperature preferences can be noted when some students are often seen wearing their coats or layered sweaters indoors on warm days, while others have a preference for cooler temperatures. Attention to some of these environmental details can be carried over to home study environments as well. Individual student-teacher discussions may reveal environmental preferences, such as those for studying while reclining or while music is softly playing, that may be more easily accommodated at home.

Sociological elements can be addressed in how teachers structure learning activities. Do certain students always prefer to work by themselves, in pairs, in small groups, or only with an adult or authority figure? Math and science instructors may vary the way they require students to work together, noting the number of opportunities in a given week or month that students are able to work in the various social arrangements. Teachers may also encourage students to study or prepare assignments outside of class using particular social arrangements and discussing the results following assignments or assessments.

Some science or mathematics instructional strategies can easily be adapted to include elements of the Dunn Model. For example, having students move around the room at teacher-directed time intervals in order to complete practical questions for laboratory exercises or make observations can be great for students requiring much mobility or kinesthetic activity. Allowing students to use blackboards, bulletin boards, and large floor space to demonstrate mathematical concepts or team teaching tasks can be enriching. Varying assessment strategies and employing peer review, portfolios, and interviewing, or similar techniques can tap learning strengths. Assignments and activities can be structured to include some flexibility so students can utilize perceptual strengths (visual, auditory, kinesthetic, or tactile). Science and mathematics labs can emphasize the use of tactual manipulation of materials, the use of demonstrations that capitalize on more than one perceptual element, and varied social groupings.

Psychological elements can be addressed by considering the manner in which lessons are initiated. Sequential and analytic teachers often prefer to get to the details of a lesson while global students may need a hook or meaningful overview before focusing on the details. The planned use of stories, cartoons, anecdotes, and diagrams can help global students see how details fit into a larger schema. Biographical anecdotes of historical mathematicians or scientists can put a personal face on otherwise impersonal content. Varying assignments to accommodate student preferences, sometimes with increasing structure and guidance, sometimes with increasing freedom and open ended outcomes may attend to psychological preferences. Students need to spend time working with the finer details and the larger interdisciplinary scope of concepts. (Caine & Caine, 1991)

LEARNING STYLES AND EDUCATIONAL REFORM

Many elements in the Dunn Model complement the reform efforts in mathematics and science education that emphasize increased attention to student centered learning. Attention to learning styles is attention to individual differences and individual strengths. Recognizing such differences should lead educators to consider how they teach to meet such differences or allow students some flexibility in completing assignments or projects. We often recognize such differences in adults, but we sometimes ignore the presence of such differences in children. Individual time-of-day preferences and organizational differences are two good examples. Not everyone is equally productive at the same time of the day, and some individuals require more frequent breaks, especially during long blocks of time. Others may need more structure or detailed instructions. These are but a few of the differences we may notice in our students.
Constructivist approaches to learning also focus on the personal strategies used when making sense of new information. Attending to learning style differences among students expands the opportunities for students to build upon previous knowledge through a variety of learning modalities. By expanding the range of instructional approaches, teachers increase the likelihood that individuals will construct meaning from active learning experiences that correspond to one's learning style.

Mathematical problem solving patterns and preferences can also be discussed in light of learning style preferences. Projects such as the Cognitively Guided Instruction (CGI) project at the University of Wisconsin emphasize that teachers create mathematical learning environments that resonant with teacher styles, as well as, with student needs and differences. Engaging activities linking mathematics with other disciplines using manipulative and creative problem-solving experiences are often welcomed by students with global or non-traditional learning styles. Problem solving also may be done in various social group arrangements and may allow students more responsibility for their own learning. The standards advocated by both mathematics and science educators promote active learning experiences that resonate with students' strengths and cognitive abilities.

But perhaps the greatest benefit from attending to learning styles in mathematics or science education is that of placing more responsibility for learning on the students themselves. Students who discover and understand their personal learning styles can and often do apply such information with great success and enthusiasm. (Griggs, 1991) Thus, attending to learning styles can be an ongoing consideration and aid in attacking new or difficult learning situations and the processing of information.

As we learn more about the physiological and neurological functioning of the human brain, attending to learning styles becomes more credible and accepted. Mathematics and science educators can utilize such findings in small but significant ways. And while many elements of individual learning styles may be obvious to educators, students may not be aware or appreciative of them. Thus it is important for educators to help individual students discover, utilize, and appreciate their own unique learning styles.

We all have our own style, whether we are considering how we dress, how we interact with others, or how we learn. Attending to learning styles helps teachers adjust instructional strategies to foster increased learning among individuals, and it helps students take more responsibility for the conditions of their own learning.

REFERENCES

- Caine, R., & Caine G. (1991). "Making connections: Teaching and the human brain." New York: Addison-Wesley.

- DeBello, T. C. (1990). Comparison of eleven major learning style models: Variables, appropriate populations, validity of instrumentation, and the research behind them. "International Journal of Reading, Writing, and Learning Disabilities," 6, 203-222.

- Dunn, R. & Dunn, K. (1978). "Teaching students through their individual learning styles: A practical approach." Englewood Cliffs, NJ: Prentice Hall.

- Dunn, R., Dunn, K., & Price, G. E. (1979, 1980, 1990). Productivity Environ-mental Preference Survey. Obtainable from Price Systems, Box 1818, Lawrence, KS 66044.

- Dunn, R. & Dunn, K. (1993). "Teaching secondary students through their individual learning styles: Practical approaches for grades 7-12." Needham Heights, MA: Allyn and Bacon.

- Griggs, Shirley A. (1991). "Learning styles counseling." Greensboro, NC: ERIC Counseling and Student Services Clearinghouse.

INTERNET RESOURCES

- http://www.ascd.org/services/eric/ericlngs.html (Provides abstracts on articles pertaining to learning styles.)

- http://hcs.harvard.edu/~husn/index.html (Identifies various relevant organizations and brain research sites.)

- gopher://sjumusic.stjohns.edu:70/1-GOP/@lsi%3Alsi.papers (Dunn learning styles site)

WHERE TO GO FOR MORE INFORMATION

- The ERIC database includes bibliographic information on over 5,000 items with "cognitive style" as an indexing term. Cognitive style is the ERIC Descriptor that is used to index materials pertaining to learning style. Related items may also be located by searching on such Descriptors as: learning strategies, learning modalities, individual differences, or environmental influences. Of particular relevance is a manual by Rita Dunn on "How to implement and supervise a learning style program, published in 1996 by the Association for Supervision and Curriculum Development [ED 395 367] You can search the ERIC database on the World Wide Web at either of these locations: [http://ericae2.educ.cua.edu/search.htm] or [http://ericir.syr.edu/].

Dr. Barbara S. Thomson is an associate professor in science education at The Ohio State University, and John R. Mascazine is a doctoral student in the science education program at The Ohio State University.

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