

# Defining Individual Learning Styles for Learning Anatomy in a Technology-enhanced Learning Environment

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## Introduction

This exploratory study was part of the contextual analysis of anatomy teaching and learning for the Visible Human Project at University of Michigan. Research showed that differences in learning styles exist among students in the same class and also between students in different disciplines (Kolb, 1984). Understanding learning styles can help teachers design curriculum suitable for students' needs, and consequently enhance students' learning, retention, and knowledge retrieval (Federico, 2000). Studies about learning technology have aimed at examining the relationship between the effectiveness of different instructional mechanisms and students' learning styles (e.g. Ross & Schulz, 1999; Ross & Robert, 1999). However, there have been very few studies discussing results from learning style survey in relation to students' perceptions and experiences gained in an actual learning process. In some research, students answered the survey questions designed out of the learning context (e.g. Grasha, 2000); in some others, the researchers only provided one-time experiential treatment for their participants (e.g. Ross & Schulz, 1999). Thus, by survey analysis and case studies, the goal of this study was to present the association between different learning styles and students' perception of computer use for anatomy learning.

## Methods

The study was conducted in the medical school with 21 students in the pre-matriculation program. The first part of the survey was constructed around five attributes of learning styles: 1) focus on big picture versus focus on details, 2) prefer to follow procedure versus prefer to work at personal pace, 3) need hints and help for problem solving versus prefer to solve problems by myself, 4) define myself as a verbal person versus define myself as a visual person, and 5) prefer to work alone versus prefer to work in group. All data from the survey was then input into SPSS for Multi-Dimensional Scaling (MDS) analysis.

A semi-structured, individual interview was conducted with two students in one selected group that have been observed by the first author throughout the whole program. The students were asked of their perceptions of 1) how they studied for the gross anatomy class, 2) how they perceived their use of a computer, and 3) their suggestions regarding the online materials. Interview data were then compared and contrasted with the results of MDS analysis. In combining qualitative and quantitative methodologies, the analysis was focused on how different attitudes toward the five attributes in the survey related to students' perspectives.

## Results

### 1. Individual and collective learning styles

The results of MDS by category (see Fig. 1) shows that the five attributes, representing five distinct aspects of students' learning, distributed evenly along the two dimensions. Individual student's learning styles are presented in Figure 2. The diagram shows that the major learning styles are defined in the first quadrant ( $n = 5$ ), the second

quadrant (n = 7) and the fourth quadrant (n= 6). The two selected students, Kenneth\* (case 13) and Jen\* (case 11) fall in the opposite quadrants on the MDS chart.

## 2. Different perceptions of computer use for learning anatomy

In Figure 3, the distinct profiles of the two students' learning styles are shown. Kenneth's learning style is characterized as focusing on general ideas, recognizing and working at a personal learning pace, solving problems by himself, and preferring to learn verbally. On the other hand, Jen strongly relies on details, likes to follow procedure, needs hints to solve problems, and prefers visuals for learning.

Interview data shows that Jen and Kenneth used computers by following different learning agenda and in different learning situations. Jen tried to use as much on-line materials as possible, and she was persistent in using computer applications even some technical problems occurred. Instead, Kenneth preferred to follow one kind of learning materials, usually the textbook, and use the computer as a supplement or check list. Computer problems are unbearable and technical problems alienated him from further usage. Kenneth used a computer in the actual dissecting work when he could apply the computer information to the practical situation.

Another observation is their different perspectives about information presentation. Kenneth felt that the Anatomy Table (Gest & Burkel, 2000) was the most useful material and he liked the short statements showing the vocabulary and highlighting what is important to learn. In contrast, Jen felt the short statements on the Table were too "concentrated" and she only used them for review purposes.

The two students have different suggestions for the information organization of computer-based materials. Jen expected a *systemic* way to organize the details across different regions. While in Kenneth's case, he found it difficult to learn from the instruction presented linearly and found confused by the different presentations in different learning materials.

## Discussion and Conclusion

Jen tried to integrate all computer materials into her study sequentially and systematically across different labs. This finding is similar to Gregorc's (1985) research of sequential students who like to follow procedure and focus on details. As for Kenneth, he highly integrated computer use into the dissecting and flexibly used computer-based materials according to his personal preference for learning. Kenneth learning styles are similar to what is described as random individuals (Butler, 1994). Butler believed that random learners need a more flexible environment to better support their learning.

Findings of contextual and temporal differences in using computer between the two students provide educators an example to consider whether structures and scaffolds should be applied to computer use. For example, students who focus on details of the learning materials may need more learning materials while students who focus on the big picture found the volume of information creates confusion. An instructional design that may benefit both types of learners is to implement a meta-structure to the learning materials. Meta-structure can be a concept map

that shows the relationships between different concepts or it can be meta-cognitive scaffolds (Hannafin, Land, & Oliver, 1999) that lead the students through certain pathways. Students will see and control the levels of details that they would like to explore to.

It is worth noting that the tendency of using a computer is not only guided by learning styles but also related to students' access to computers, level of comfort with computers and attitude toward technology. Kenneth defined his general learning style as oriented by experiential experience of solving problem. However, he did not perform as an active learner exploring different online materials. He relies more on guidance from the instructor and the facilitators. While it is believed that the Internet can encourage self-directed learning in medical education (Anderson, 2000), there are certain factors that should be taken into account by educators. It is important to orientate students to be an active learners and realize the value of information for learning. For students in the health-care system, this may be the first step of preparing them to face a technology-enhanced career environment.

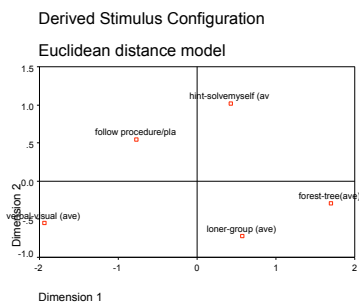


Fig. 1 Multi-dimensional scaling by categories

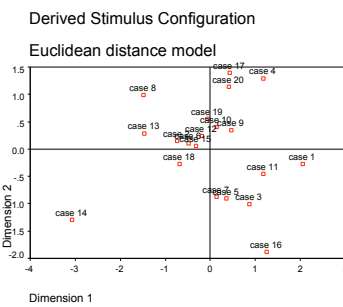


Fig. 2. Multi-dimensional Scaling by cases

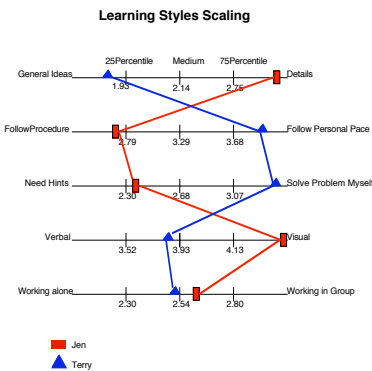


Fig. 3 The scores of each attributes were compared to the medium, 25 percentile, and 75 percentile of the whole class.

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