Chapter 6
An Educational Method for Theoretical Fields Through Dynamic Visualization

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ABSTRACT

This chapter proposes a new educational methodology for theoretical contents. It aims to effectively transmit theoretical content meanings. Here, the effects of content visualization enhance the transmission of meaning. By processing visual information, the human brain can immediately understand the mutual relationships between elements in addition to the whole meaning. Comprehension becomes increasingly effective when movement is added to static information. The new educational methodology proposed here is based on such visualization. It is called "The Dynamic Visualization Method." It is designed so students can visually set allowable conditions before processing them. This selective freedom enables students to extract their hidden leaning interests. Mathematical processes were used to verify the effectiveness of this methodology. A variety of items were thus adopted ranging from the elementary-school to university levels. The contents of those items are visualized in this chapter. The educational effects are then discussed.

INTRODUCTION

Society is changing at a dizzying rate. This is especially pronounced in the IT field. In an ever-changing society, creativeness is far more important than memorization. This is because static memorized knowledge quickly loses its value due to changing surroundings. Consequently, every country is required to quickly develop new technologies and sciences for survival. For this reason, the conventional education system (which places importance on memory) has become ineffective. A new educational methodology is thus needed to induce student' interest and lead to creativity.

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The present author, therefore, has developed a new software to create Dynamic Visualization for mathematics problems in K-12 classrooms; the present software package is very effective for the gifted and talented students who are good at mathematics; they can improve and upgrade their skills and abilities with this wonderful software. The present package may be also very effective for students and adults who want to get the remedial courses in mathematics.

REQUIREMENT FOR DESIRABLE EDUCATION

Here, the essential requirements for desirable education are considered. First, proper education should extract the hidden interests of students. These are induced by things they find meaningful. Such interests promote learning pleasure. This has been the very object of education from ancient times.

One of the best ways to transmit meaning is by visualizing contents. Concerning management of the visualized information process, ocular function is quite wonderful in understanding the meanings of element's mutual relations.

Suppose a continuous movement was added to a static visualized image. One can extract the mutual dynamic functions of each element and the core structure of the phenomena at a deeper level through such visualized information. Student interest is further induced by this acquired deep understanding. The induced interest tends to lead the student to creativeness.

Another indispensable requirement for a proper education is that it allows students to participate in the teaching procedure. It is hoped that these procedural conditions are controlled by the students to some extent throughout the process. It is desirable that the student have the opportunity to set problems at will.

MAIN FOCUS OF THIS CHAPTER

Aiming at the construction of an effective educational methodology for theoretical contents, a system should be designed to examine desirable items.

A theory's "function" is interpreted and defined as a type of driving force that gradually transforms a given initial state into a final state following its own procedure.

System flow dictates that an initial state will first be visualized. At this point in the system design, it is required that students be allowed to establish an initial state through willful visual operation. This established initial state is then transformed into another state following the function of the theory and the directions indicated by the student. These transformed states are simultaneously visualized until the transformation reaches the final state. Students will obtain the kernel meaning of the theory by observing these continuously visualized images. These processes are shown in Figure 1.

Visualization should be designed based on each character of the treating contents. Detailed points in the system design are clearly mentioned through an explanation of each introduced example.

Mathematics was chosen as representative theoretical field. Here, vast contents range from the elementary to university level. These are designed and programmed for visualization.

The "Visual Basic" computer language was used to construct the "Dynamic Visualization System" (display resolution was set to 1920×1080). This was the main premise; every system detail was prescribed using Visual Basic.