

# eLearning Pedagogical Design: TSOI<sup>®</sup> Model

Mun Fie TSOI, Ngoh Khang GOH and Lian Sai CHIA

Natural Sciences & Science Education, National Institute of Education,  
Nanyang Technological University, Republic of Singapore  
1 Nanyang Walk, Singapore 637616  
mfrtsoi@nie.edu.sg

## **Abstract**

*The process of methodological design and development of eLearning materials for teaching and learning needs to be guided by educational theories or models. This issue is addressed in this paper providing an emerging pedagogical design for eLearning, a hybrid learning model, TSOI<sup>®</sup> model. The TSOI<sup>®</sup> model's goals are to enhance not only concept learning but also learning styles inclinations in a diverse learning environment.*

*The TSOI<sup>®</sup> model of learning represents learning as a cognitive process in a cycle of four phases, namely, Translating; Sculpting; Operationalizing and Integrating. Pedagogical principles of the TSOI<sup>®</sup> model are applied to science and chemical education. This is illustrated in terms of instructional storyboarding linking to the eLearning product developed. Implications for the science of instruction in eLearning pedagogical design are discussed.*

## **1 Introduction**

The iterative process of design and development of eLearning materials commonly delivered via the World Wide Web often need to be guided by sound and relevant educational theories (Mayer, 2001; Norman & Spohrer, 1996). Given the enormous amount of content or information to be delivered coupled with proven

instructional approaches as well as powerful multimedia systems, it is still envisaged as an uphill task of creating effective multimedia learning materials. This is more so especially due to a lack of effective and practical design framework or a set of guidelines for organizing and designing multimedia learning materials (Tsoi, & Goh, 1999; Tsoi, Goh & Chia, 2003). As such, the following sections provide an insight on a hybrid learning model for eLearning pedagogical design.

## **2 Details of the hybrid learning model**

The hybrid learning model differs from the traditional model of "Transmit-Receive" which when applied to eLearning, has so far failed to engage meaningful learning in learners (Scardamalia & Bereiter, 1993; Tsoi et al., 2004, 2005). Hence, this hybrid learning model focuses on not only to improve concept learning but also to address the different learning styles. The theoretical framework rests on the two well established learning models namely, the Learning Cycle model, and the Kolb's experiential learning cycle model. The Learning Cycle model is an inquiry-based learner-centered learning cycle representing an inductive application of information processing models of teaching and learning. The learning cycle consists of three phases in a cycle: (a) exploration, (b) concept invention or term introduction, and (d) concept application (Karplus, 1977;

Lawson, 1995). The exploration phase focuses on “what did you do?” and the concept invention phase places emphasis on the data obtained i.e. “what did you find out?” while the third phase, the concept application phase is for applying the concept learned in diverse problems. The Kolb’s experiential learning cycle model (Kolb, 1984) represents learning as a cognitive process in a cycle of four stages: (a) concrete experience, (b) reflective observation, (c) abstract conceptualization, and (d) active experimentation. The concrete stage is about the “doing” part while the reflective observation is about the “understanding the doing” part. The abstract conceptualization stage involves the “understanding” part while the active experimentation stage focuses on the “doing the understanding” part. Indeed, Bostrom et al. (1990) also in the study conclude that learning styles are an important factor in computer-based training and learning.

Thus, the hybrid learning model is synthesized from the above two well researched learning models. This hybrid learning model is termed the TSOI<sup>®</sup> model of learning and is represented as a cognitive process in a cycle of four phases: (a) Translating, (b) Sculpting, (c) Operationalizing, and (d) Integrating. Figure 1 shows the four phases of the TSOI<sup>®</sup> model of learning.

### 3 Pedagogic application

For illustration, in the science and chemical education, the mole concept is used. The nature of the mole concept is abstract making both the teaching and learning difficult. The subtopic is relative atomic/ molecular mass, Avogadro’s number, and the Mole. In the Translating phase, an activity focuses on the relationship between mass and number of particles. The multimedia experiences are translated into a beginning idea or concept of mass ratio

which is then further engaged in the second phase, the Sculpting phase.

This beginning idea or concept still in its raw form is sculpted or shaped by instructional learning activities that help the learner to identify the critical attributes of the concept thus leading to a more concrete form. For example, the understanding of the physical meaning of Avogadro’s number and the Mole is performed in an activity that involves the learner to choose a mole of atoms of an element from the periodic table provided and balance it with the correct number of particles. Elements when moved onto the balance are represented appropriately at room temperature and pressure either in its solid or gas state macroscopically and symbolically. This is then repeated for a comparison leading to observations in terms of mass and number of particles as illustrated in the instructional storyboard (see Figure 2).

In the Operationalizing phase, the concept is to be internalized entailing meaningful functionality which can be in the form of quantitative relationships. The activities are designed to allow operability of the mole at the three levels namely, the macroscopic, microscopic, and symbolic. Besides, self-questioning is embedded and conversational style as in the personalization principle (Mayer, 2001) is also applied. Multimedia learning design principles such as principle of contiguity, modality, redundancy, and coherence are also used (Mayer, 2001). Generic questions such as “How are your observations and that of previous alike?”, “How do you do it?” are posed to elicit patterns of thinking. The Integrating phase provides the opportunities for applications to diverse problems. On completion, review questions are posed to the learner, for example “What have you learnt regarding one mole and the number of particles?” and “How is the mass of substance connected to the mole?”.

#### 4 Conclusions

The importance of first identifying the attributes of the concept is essential as this lead to “crafting” relevant and meaningful instructional activities to help the learner to identify these critical attributes for conceptual understanding and learner style inclinations. The Translating phase (concept initial exploration) is similar to the exploration phase of learning cycle and the concrete experience of experiential learning cycle. The Sculpting phase (concept construction) is similar to the concept invention phase of learning cycle and the reflective observation phase of experiential learning cycle. The bridging Operationalizing phase (concept internalization) is similar to the abstract conceptualization phase of experiential learning cycle while the Integrating phase (concept application) is similar to the concept application phase of learning cycle and the active experimentation phase of experiential learning cycle. Essentially, the TSOI® model of learning has the capacity to address conceptual learning and learning style inclinations.

#### 5 References

- Bostrom, R. P., Olfman, L., and Maung, S. K. (1990) “The Importance of Learning Style in End-User Training”. *MIS Quarterly*, March 1990.
- Karplus R. (1977) *Teaching and the Development of Reasoning*. Berkeley: University of California Press.
- Kolb, D. (1984) *Experiential Learning: Experience as the source of Learning and Development*. Englewood Cliffs, N. J.: Prentice Hall.
- Lawson, A. E. (1995) *Science Teaching and the Development of Thinking*. Belmont, CA: Wadsworth.
- Mayer, R.E. (2001) *Multimedia Learning*. New York: Cambridge University Press.
- Norman, D. A., & Spohrer, J. C. (1996) “Learner Centred Education”. *Communications of the ACM*, 39,4, 24-27.
- Scardamalia, M., & Bereiter, C. (1993) “Technologies for knowledge-building course”. *Communications of the ACM*, 36,5, 37-41.
- Tsoi, M.F., Goh, N.K., & Chia, L.S. “Multimedia learning design pedagogy: A hybrid learning model”. *Journal of US-China Education Review*, USA (Sep 2005), 2(9), 59-62.
- Tsoi, M.F., Goh, N.K., & Chia, L.S. “Multimedia Design: A Hybrid Approach”. [CD-ROM]. Paper from: SEAMEO-UNESCO Education Congress & Expo in Education Item: DDR 4705178. Bangkok, Thailand. (2004)
- Tsoi, M.F., Goh, N.K., & Chia, L.S. “A Hybrid Learning Model for Designing Interactive Multimedia”. In Soraj Hongladarom (Eds.), *Proceedings of International Conference on Information Technology and Universities in Asia*. Thailand: Chulalongkorn University Printing House (2003), 535-542.
- Tsoi, M.F., and Goh, N.K. (1999) “Practical multimedia design for chemical education”. In J. Breaker et al. (Series Eds.) & G. Cumming et al. (Vol Eds.), *Advanced Research in Computers and Communications in Education: Vol.1*. New human abilities for the networked society. The Netherlands: IOS Press, 946-949.

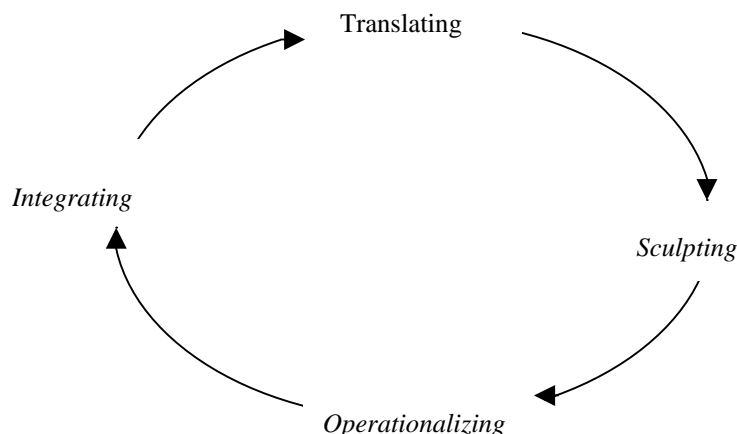


Figure 1 TSOI<sup>©</sup> model of learning

	<b>Animation</b>	<b>Narration</b>	<b>Text on Screen</b>
	<p>Both balanced pictures remain showing number of particles to be <math>6.02 \times 10^{23}</math> and the respective masses.</p> <p>Pop-up box for keying in response / Enter.</p> <p>Pop-up feedback box.</p> <p>Diagrams, response box and feedback box are to be on the same fixed screen.</p>	<p>Compare the two diagrams.</p> <p>What have you observed in terms of mass &amp; number of particles? How are the observations in this activity alike?</p>	<p><b>Relative Atomic/Molecular Mass, Avogadro's Number and Mole</b></p> <p><i>Physical Meaning</i></p> <p>- Avogadro's Number and Mole</p> <ol style="list-style-type: none"> <li>1. The masses of a mole of atoms of 2 different elements are not equal.</li> <li>2. The number of particles in a mole of atoms of 2 different elements are equal.</li> <li>3. The number of particles in one mole of any substance is <math>6.02 \times 10^{23}</math> called Avogadro's number.</li> </ol>

Figure 2 Instructional storyboarding