Multimedia Learning Design Pedagogy: A Hybrid Learning Model

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Abstract: This paper provides insights on a hybrid learning model for multimedia learning design conceptualized from the Piagetian science learning cycle model and the Kolb's experiential learning model. This model represents learning as a cognitive process in a cycle of four phases, namely, Translating, Sculpting, Operationalizing, and Integrating and is intended to address both concept learning and learning style inclinations. Pedagogical principles of the model are applied to develop an e-learning product for multimedia learning in chemical education in a postgraduate teacher-training program using the Mole, an abstract and complex concept as an example. Instructional storyboarding is provided to illustrate some of the processes elicited, for example, thinking skills and self-questioning. The science of instruction in multimedia learning design principles, for example, principles of contiguity, modality, redundancy, personalization and coherence, is also discussed.

Key words: multimedia learning design pedagogy learning model

1. Introduction

The process of methodological design and development of multimedia learning materials whether they are to be delivered in the form of a CD-ROM or the World Wide Web often need to be guided by educational theories (Norman and Spohrer, 1996; Mayer, 2001). Although designers of multimedia learning environments often have a large amount of information, proven instructional methods and powerful multimedia systems, it is still a difficult task to produce effective multimedia materials. This is more so especially due to lack of effective yet practical design model for organizing and designing multimedia materials (Tsoi et al.1999; 2000).With this in mind, the following sections provide an insight on a conceptualized hybrid learning model for multimedia learning design pedagogy.

2. Hybrid Learning Model Theoretical Framework

The hybrid learning model (Tsoi et al. 2003) is different from the traditional model of "Transmit-Receive' which when applied to multimedia learning, has so far failed to engage learners in meaningful learning (Scardamalia and Bereiter, 1993). As such, this learning model for the design of multimedia aims to enhance concept learning as well as to cater to different learning styles. The theoretical basis of this hybrid learning model is derived from the Piagetian learning cycle model and the Kolb's experiential learning model.

The Piagetian learning cycle model is an inquiry-based student-centered learning cycle representing an inductive application of information processing models of teaching and learning. It has three phases in a cycle:

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exploration, concept invention and concept application (Karplus, 1977; Renner and Marek, 1990; Lawson, 1995). The exploration phase focuses on “what did you do?” while the concept invention phase centers on “What did you find out”. The third phase is for application. The Kolb’s experiential learning cycle (1984) represents learning as a process in a cycle of four stages, namely, concrete experience, reflective observation, abstract conceptualization and active experimentation. The concrete experience stage focuses on “doing”. Reflective observation stage is about the “understanding the doing”. The abstract conceptualization stage focuses on “understanding” while the active experimentation stage is about “doing the understanding”. Bostrom et al. (1990) also conclude that learning style is an important factor in computer-based training and learning.

Hence, a synthesis of both the Piagetian learning cycle model and Kolb’s experiential learning cycle model has evolved a hybrid learning model. This hybrid learning model termed the TSOI© model represents learning as a cognitive process in a cycle of four phases: Translating, Sculpting, Operationalizing, and Integrating. Figure 1 shows the four phases of the TSOI© model of learning.

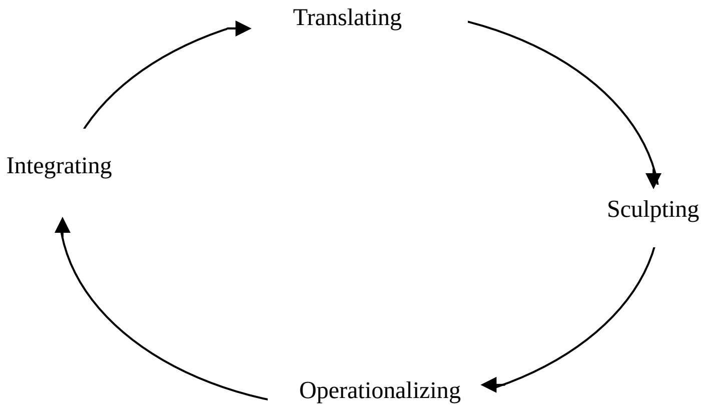

Figure 1 TSOI© Model of Learning

3. Design Pedagogy Application

For illustration, in chemical education, the mole concept, an abstract concept is used (Tsoi et al. 1998). The subtopic 1 is relative atomic/molecular mass, Avogadro’s number and Mole. In the Translating phase, the activity explores the relationship between mass and number of particles. The experiences are translated into a beginning idea or concept of mass ratio which is needed to understand Avogadro’s number and Mole in the Sculpting phase. This takes place as a chain of logical events of content sequencing, learner guiding and reflecting shown in Table 1 to Table 2 as instructional storyboarding. One of the activities on “physical meaning” at a microscopic (particle) level involves the learner comparing the masses of various atoms with annotations. The various atoms are displayed with the appropriate color and size. This is essential to enhance the first activity on finding out how heavy a single atom of carbon is leading to the idea that the actual mass of an atom is very small and hence, the need to compare masses of different atoms with each other including mass ratio. Activities as shown in Table 1 and Figure 2 will lead to the fundamental concept that relative atomic mass is a number used to compare the masses of different atoms and it has no units.

Table 1 Instructional Storyboarding

S/N	Animation	Narration	Text on Screen
1.2c	Display diagram B1 and diagram A	Use information in diagram A to create your relative atomic mass scale.	Relative Atomic/Molecular Mass, Avogadro’s Number and Mole

	Student's creation matches diagram B2	Drag the carbon atom to the relevant point on the scale. Place the other atoms appropriately on the scale. Put in the relevant descriptions.	*Physical Meaning* - Relative atomic mass, A_r To summarize, you are to create a relative atomic mass scale.

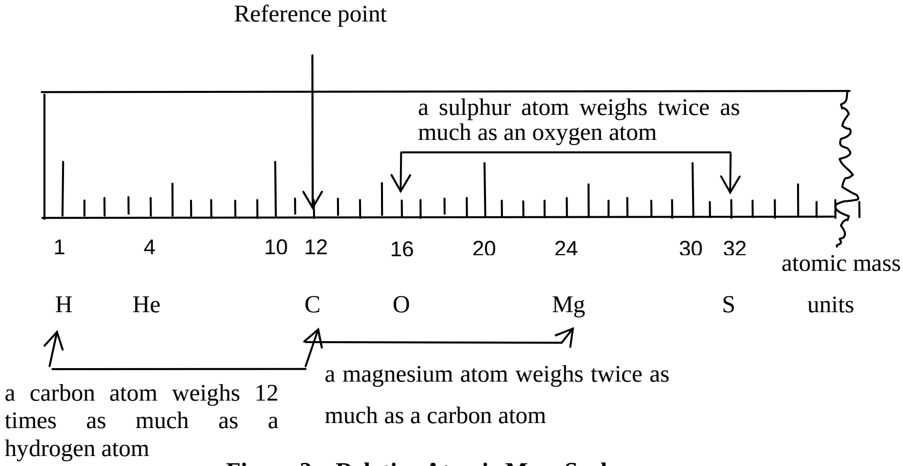

Figure 2 Relative Atomic Mass Scale

The activity in Table 2 provides a path for infusing thinking skills and consolidating the understanding of the physical meaning of Avogadro's number and Mole as well as their relationship before proceeding to the Operationalizing phase which is vital for concept formation. The initial activity focuses on the physical meaning of Avogadro's number and mole. The learner chooses a mole of atoms of an element from the periodic table and balances it with the correct number of particles. This is then repeated with a different element. The element when dragged onto the balance is represented appropriately at room temperature and pressures either in its solid state or in its gaseous state; it will be in the form of a balloon as well as in its chemical formula or symbol. In this way of representation, a macroscopic as well as a symbolic view is provided. Finally, the learner has the opportunity to compare these two diagrams in terms of mass and number of particles. The learner can also check the observations made to the feedback given.

Table 2 Instructional Storyboarding

S/N	Animation	Narration	Text on Screen
1.2g	Both balanced pictures remain showing number of particles to be 6.02 x 10^{23} and the respective masses.	Compare the two diagrams. What have you observed in terms of mass & number of particles? How are the observations in this activity alike?	**Relative Atomic/Molecular Mass, Avogadro's Number and Mole** *Physical Meaning* - Avogadro's Number and Mole
	Pop-up box for keying in response / Enter. Pop-up feedback box. Diagrams, response box and feedback box are to be on the same fixed screen.		1. The masses of a mole of atoms of 2 different elements are not equal. 2. The number of particles in a mole of atoms of 2 different elements are equal. 3. The number of particles in one mole of any substance is 6.02 x 10^{23} called Avogadro's number.

In this Sculpting phase, the concept still in its beginning or raw form is sculpted or shaped by various relevant and meaningful activities. Conceptually, the three key points observed as shown in Table 2 are essential to understanding the relationship between mass and mole as in the beginning activity of the third phase, the Operationalizing phase. This entails meaningful functionality whereby the concept is operationalized. Quantitative relationships in the form of mathematical formula are acquired through relevant activities to allow operability of the mole at the three levels, namely, the macroscopic, microscopic and symbolic. Besides, self-questioning is embedded and the use of conversational style as in the personalization principle (Mayer, 2001) is also applied. Generic questions such as “How are the observations in this activity alike?”, “How do you do it?” are provided for self-questioning. In the Integrating phase, relevant and diverse problems are provided. On completion, the learner is posed reviewing questions such as “what have you learnt regarding one mole and number of particles?” and “how is the mass of substance connected to the mole?”.

4. Conclusions

The need to first identify the attributes of the concept is essential so that varied activities in the 4 phases can then be “crafted” to assist the learner to identify these critical attributes and eventually leading to acquisition of concept mastery and exposure of learner style inclinations. Misconceptions can also be confronted in the Sculpting phase which is similar to concept invention phase of learning cycle model and reflective observation stage of the experiential learning cycle. The Translating phase is similar to exploration phase of learning cycle model and concrete experience stage of experiential learning cycle. The Operationalizing phase similar to the abstract conceptualization stage of the experiential learning cycle involves increasing the understandings of the relationship between thinking and concept acquisition and prepares the learner to be operationally ready for applications in the Integrating phase. Important is also the knowledge and application of multimedia design principles, for example, principles of Multimedia, Contiguity, Modality, Redundancy, Personalization and Coherence (Mayer, 2001) In essence, the TSOI© model of learning, a hybrid learning model for multimedia learning will have the capacity to address both concept learning and learning style inclinations.

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