

PERSONALIZED LEARNING ENVIRONMENT: VISUALIZATION THROUGH COGNITIVE STYLE

Noor Dayana Abd Halim¹, Mohamad Bilal Ali², Noraffandy Yahaya³

*Department of Educational Multimedia,
Faculty of Education,
Universiti Teknologi Malaysia 81310 Skudai, Johor, Malaysia*
¹Email: noordayana@utm.my
²Email: mba@utm.my
³Email: fandymcl@gmail.com

ABSTRACT

Corresponds to the rapid growth of online learning, the personalized learning environment (PLE) is becoming a trend in the education field. Most of the website focuses on students' personality, interests and behaviours in order to provide the personalized environment. This paper attempts to describe generally the important and uses of PLE in education. This is because many researches prove that PLE is important in order to enhance the achievement and the quality of learning among students. This paper emphasizes the implementation of PLE in order to solve the difficulties and misconceptions in chemical bond subtopic. The web will develop to provide students learning environment via visualization learning style but the flow of the content are provided in two modes which are refer to the students cognitive styles (wholist-analytic). Otherwise, this paper also discusses the mental model as the impact of learning process.

Keywords: Personalized Learning Environment (PLE), cognitive style, visualization, mental model, chemical bond

1. INTRODUCTION

In recent years, education field have moved rapidly towards integrating technology or computer in the process of teaching and learning. This is because computer has a great potential for enhancing teaching and learning outcomes. Computer is a device which can offer people wonderful experiences for teaching and learning process. It can be used to teach, manage, and also can be a communication tool and these made computer unique compared to other learning devices. Computer based learning also known as CBL is a method that had been proposed in the last decade which means that learning by using computer, or through computer giving students strengthens, motivation and new experiences in gain knowledge.

Many researchers had proved the well-crafted use of computer in education. For example computer will increased learner effectiveness of performance gains, increased learner efficiency, greater learner engagement of satisfaction and give more students attitudes towards learning. According to Noriah *et al.* (2002), the interaction among students expands beyond the time and geographical boundaries when they using computers in learning process. The more time students interact, communicate and discuss with others via online computer mediated communication, the more knowledge they will gain. This is because; students are able to interact with other students outside the classroom (within and inside the school) via chat room, email, online conferencing and video conferencing. This proved that computer provides the extra space for students to communicate or interact with others.

Nowadays, learning process is moving towards online application. Online learning education offers the same opportunity as learn in classroom. The objectives of learning are the same. Even the materials, textbooks and syllabus may be the same. But the methods are different. Online courses are geared towards convenience, first and foremost, as students will be able to commit to their courses in their own comfortable pace.

With this emerging trend, it is now feasible and affordable to integrate multimedia in educational field, resulting in a change in the teaching and learning environment. Beside the uses of CD-ROM

application to teach students, the internet is now a popular educational and informational medium for these purposes. This is because, the use of the Web as an educational tool has provided learners a new learning experiences and educators an interesting teaching environments (Nam and Smith-Jackson, 2007). The popularity of the web base learning is due to the concept of learning "anywhere" and "anytime". (Neo M. *et al.* 2008). As mentioned by Killedar M. (2008), web can be globally distributed and has a high personalized media for delivery information. So, teaching process is no longer confined to a time and place. By using this medium, the students and teacher become spatially and temporally dispersed learners. The time and the physical boundaries of the traditional classroom are no longer existed (Khalifa M. and Lam R., 2002).

According to the article that was published by Blackboard Inc in 2000, there are several benefits of using online learning in education. There are : -

1. The tools provided in web based education such as discussion board, chats and emails will increase the communication between members, motivation and participation in class discussion and projects.
2. Online forums, like Blackboard's Discussion Board and Chat provide a space for students to post information and asking questions. Each of the students can view other students answer and feedback or respond through the exposure to different perspective. Thus, students can combine the new opinions with their own and also develop a solid foundation for learning.
3. Online learning gives all students a reinforced sense of equality. Each individual has the same opportunity to "speak up" by posting messages, opinions or suggestions without typical distractions such as seating arrangements, volume of student voices, and gender biases. Consequently, students to feel more comfortable expressing and backing up facts when they posting it online instead of speaking in classroom. Plus, online discussion provokes more confrontational and direct communication between students.

Since online learning has different setting from the conventional classroom, educators need to use some special techniques to make students can learn best based on their preference. Nowadays, a personal learning environment (PLE) has emerged in educational field around the world. PLEs offer students the opportunity to have greater control of their own learning and goal setting. It also manages the process of learning more effectively and takes larger stake in the ownership of content. On the other hand, by the implementation of this website, learners can be uniquely identified, content can be specifically presented, and progress can be individually monitored, supported, and assessed.

2. PERSONALIZE LEARNING ENVIRONMENT IN EDUCATION

Online learning has changed the ways in which education has been conducted. Unfortunately, many educational websites do not employ principles of effective learning (Cook and Dupras, 2004). Since learners move online, how can we attend to the basic human attraction for individualized attention? How can we support more self-motivated, independent, and self-directed online learning? How do we provide designs that acknowledge a diverse set of personal types that influence learning? How do we provide the information and environments that match how individuals intend to learn differently? All these type of questions must be apprehension for all educators especially when developing an educational website.

Web-based information systems are increasingly being used for learning applications. Computers are becoming better and more sophisticated every day. They can already perceive information related to user needs and preferences. One possible implementation of a Web-based system's environment was referred to students learning style. This is because there are many development of the learning website but many of them lack of important considerations needed for implementing Web-based learning applications such as integration of the user interface design with instructional design and the development of the evaluation framework to improve the overall quality of Web-based learning support environments (Lekkas *et. al.*, 2009).

Recent advances in educational technology have improved educational environments by providing many enabling tools satisfying learners' diverse needs. Individual learners take advantage of self-paced learning environments in which they have control over their pace of learning, information flow, selection of learning activities, and time management (Jung, 2001). However, there are still many

controversial issues related to the effectiveness of online instruction. One claim is that online instruction lacks the ability to satisfy the diverse learning needs of online learners. Thus, identifying different types of learner variables and their impact on student learning has been a major area of study in online instruction (Smith, 1997).

Article that was published in 2009 found in Educase Learning Initiative Website mention that the term PLE describe the tool, communities and services that constitute the individual educational platforms learners use to direct their own learning and pursue educational goal. On the contrary to the conventional instruction system, at which students try to adapt themselves to the concept, personalized learning advocates that the concept has to be adapted to the individual student (Karagiannidis, Sampson, and Cardinali, 2001).

Research showed that students taught in a personalized learning environment attain a good academic result and build up socially through personal growth. These students tend to be increasingly self directed and self initiated with excellent problem solving skills (Martinez, 1999; Allen & Seaman, 2006). As mentioned by Clements and Douglas (2008) in their article titled *Personalized Learning and Innovation in Education*, there are several features about PLE. There are :-

1. Engages students in learning process, increased the responsibility and accountability of students. Students are become a creator instead of become a consumers of information.
2. Encourage student ownership of knowledge.
3. Imparts a level of autonomy students desire
4. Provides real life connection
5. Promotes creativity among students
6. Fosters critical thinking, deep learning and understanding
7. Provides a forum for sharing of ideas
8. Develops an interdependence and mutual respect between the teacher and the student.

Schaffert and Saizburg (2008) had discussed the overview about seven crucial aspects for learning process of the shift from Learning Management System (LMS) towards Personalized Learning Environment (PLE). The table below shows that the seven aspect as mentioned by them.

Table 1: An overview about seven crucial aspect of the shift from LMS to PLE

No	Aspect	LMS	PLE	Challenges & Shift
1	Role of learner	Learner as consumer of predefined learning materials, dependent on creativity of the teacher	Active, self directed, creator of content	Shift from consumer to "prosumer", self organisation is possible and necessary
2	Personalisation	.. is an arrangement of learning assignments and materials according to (proposed or pre-defined) learner's model, based on underlying expert system	.. means to get information about learning opportunities and content from community members and learning services fitting to the learner's interests	Competence for usage of several tools and a self organisation is needed
3	Content	Developed by domain experts, special authors, tutor or teachers	The infinite "bazaar" of learning content in the web, exploring learning opportunities and services	Necessary competences to search, find and use appropriate sources.
4	Social Involvement	Limited use of group work, focus on the closed learner group	Social involvement is the key for the learning process	Collaboration as the central learning opportunities
5	Ownership	Content is control by institution or teacher	Content is organised and control by learner	Awareness of personal data needed
6	Educational and	Imitation of classroom learning, course oriented,	Self-organised learner in the focus	Change of learning culture- move

	organisational culture	teacher oriented features		towards self organisation and self determination.
7	Technological aspects	Classical learning content needs interoperability between LMS and data repositories	Social software tools and aggregation of multiple sources	Required interoperability between LMS and the Social Software

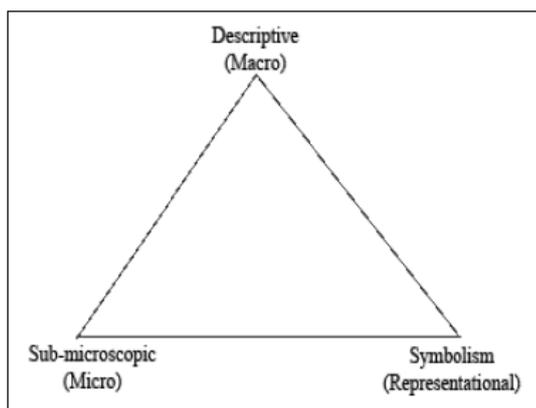
Source : (Schaffert and Hilzensauer,2008)

Thus, the challenge for educational practice will be to develop, realise and establish new approaches. This means that the advantages of the concept of PLE, not should only maintain a teacher centred and passive approach of learning, but facilitating a new dimension for learning and teaching process. As the paradigm shifts towards PLE, educators are becoming optimistic and learners becoming creative. This is because, the appropriate and creative use of technology will foster more successful learning outcomes.

3. DIFFICULTIES AND VISUALIZATION IN CHEMISTRY

Chemistry is one of the most important branches of science (Sirhan, 2007). By learning this subject, it enables learners to realize what happened around them. Chemistry concept are abstract and generally related to based or structure of matter. This subject also involves the variety of visual representation of chemical compound and structure (Gilbert, 2005). This is why students regarded chemistry as a difficult subject. According to Taber (2008) the abstract concept in chemistry are central to further leaning in chemistry and also other science subjects. Furthermore, the constant interplay between the macroscopic and microscopic level of thought give significant challenge to students to understand more in these subject (Bradley and Brand, 1985).

Chemical knowledge is learned at three levels: sub-microscopic, macroscopic and symbolic. This three levels are link with each other in *Chemistry Triangle* (Treagust *et al.*, 2003). The interactions and distinction between them are important characteristics of chemistry learning and necessary for mastering the chemical concept. Therefore, if students face difficulties at one level, it may influence the other. Students are live and imagine in the macroscopic of matter. Consequently, students can't follow the shifts between the macroscopic and microscopic levels (Robinson, 2003). Thus, it is important to educators for determining and overcoming these difficulties (Sirhan , 2007).



Source : (Sirhan,2007)

Figure 2 : Chemistry Triangle

The nature of bonding between those particles is used to explain many of the chemical and physical properties of the substances in chemistry subject. Else, the models are seen to be a theoretical content of chemistry (Nahum *et al.*, 2004). According to Gilbert (1997), models play a role major in all science disciplines. Nevertheless, they seem to be particularly problematical to chemistry students. On the other hand, students live and operate in the macroscopic world of matter. Unfortunately, they

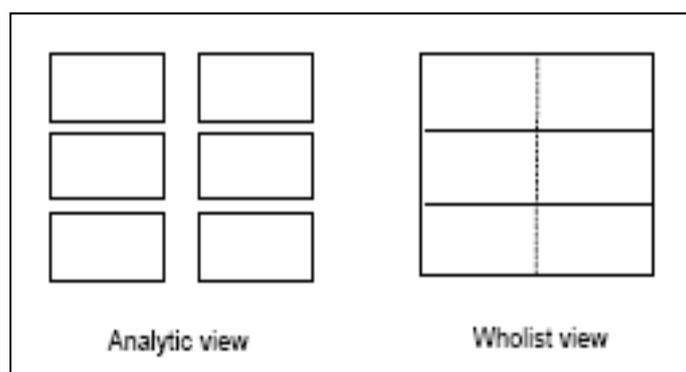
do not perceive chemistry as related to their surroundings. Else, they do not easily follow shifts between the macroscopic and microscopic levels. All these unable skills give students difficulties in visualize the bonding in chemical substances

In the science education literature, there have been numerous studies to determine students' understanding and misconceptions about chemical bond. As mentioned by Ozmen (2004), student's misconceptions and alternate conceptions about these microscopic particles will impede further learning of Chemistry. In a study conducted by Coll and Treagust (2001) towards year-12 students' mental model for chemical bonding revealed that students use simple, realistic mental models for chemical bond. And also, learners' mental models of bonding become sophisticated and complex when they were asked to explain bonding of substances. Research that had done by Gilbert (2005) stated that, in conventional classroom, teachers use the plastic ball and stick as a model to help students visualize the proper image of the bonding in chemistry substance or molecule. Unfortunately these models are static in nature and do not allow students to see dynamic interactions between molecules. Many students often fail to understand the relationship between the models with the real molecule.

An understanding of the concept of bonding is fundamental to subsequent learning of various topics in chemistry such as chemical equilibrium, thermodynamics, molecular structure, and chemical reactions (Ozmen, 2004). This is because the concept of this topic is one of the most useful, and at the same time is one of the most difficult to understand in all of chemistry. According to Davies *et al.* (2009), visualization is a key to understand and depict the chemical bonding. According to Gilbert (2005) the term visualization can be defined as a novel visual presentation of data. Its include line drawing of data patterns, detailed 3-dimensional mapping and hypermedia-based environment.

Besides, Gilbert (2005) in his book stated that visualizations can influence learning in a positive way. It is because visualization involves the cognitive activities in student's mind that demonstrated to enhance learning in other instructional situation. He also said that, visualization is the factor that may facilitate student construction of mental model in order to process information. All these claims are referred to cognitive in students mind. Thus, several researchers concluded that satisfying online learners' cognitive styles was a critical success factor for online instruction (De Raad,1996) and suggested further research studies to identify instructional strategies addressing online learners' cognitive styles to improve student's learning outcomes (Liu & Reed, 1994).

According to Riding (1991), there are two type of cognitive style which are wholist and analytic (see Figure 1). Wholists persons tend to see the whole of situation have an overall perspective and appreciate the total content. In contrast, analytic see the situation as a parts and often focus on one or two things at one time, to the exclusion of the others. An implication of this style in learning are, wholists need help in seeing the section of learning material, and dividing the whole into its parts. But, analytics require a unifying overview to be provided so, that they can integrate the sections into a whole view.



Source : (Riding, 1991)

Figure 2 : Analytic and Wholist views of information

When a process of learning had occurred, learners construct a new knowledge and modify the knowledge (Tzeng & Schwen, 2003). One way to measure this learning is to examine the mental models of learners since they can reflect the type and level of construction that had occurred. From the several of study, it is clear that researcher would be interested in the notion of mental model. This is because; they agree that mental models capture a type of memory that teachers want students to build (Gilbert, 2005).

4. CONCLUSION

Chemistry is not an easy subject to learn (Chittleborough, 2004). Many people regard chemistry as being too hard, too abstract, too mathematical, and only for very bright students. As a result a negative attitude has developed about chemistry with students claiming chemistry is boring (Justi and Gilbert, 2002). Chemical model and representations play a vital part in the teaching and learning of chemical concepts. According to Ozmen (2004), chemical bond is one of the most important topics in chemistry subject and the topic involves the use of a variety of models varying from simple analogical models to sophisticated abstract models. In the science education literature, there have been numerous studies to determine students' understanding and misconceptions about the ionic and covalent bonding. On the other hand, the online learning that ignore the personality types of students make the learning process not effective. The dummy information that located in the website not satisfied the learners' preference. This is because individuals are different in their ways of seeking and processing the information. The focus is on cognitive style as they personalized environment and the mental model as the impact of information processing.

As a conclusion, educators need to develop an educational environment that will appeal to the different learning styles of students. It is also vital that students have an understanding of their own learning styles to improve the speed and quality of their learning. With this in mind, it is endeavoured to explore additional avenues, such as visualization to provide students with a wider range of learning materials. On the other hand, the visualization tools stand to aid students' perception and mental manipulation of three dimensional models for atom, molecules and bonding. This tool can also provide virtual models of actual molecular structure and the formation of bond that maintain a high degree of fidelity with the real molecule. Perhaps, the personalized learning environment has the potential to provide an environment that allows students to experience learning in their context and these experiences will enrich and change their mental models.

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