INTELLIGENT TUTORING SYSTEM BASED ON PEDAGOGY AND ANDRAGOGY ORIENTATION

[1]Norah Md Noor, Dr. Jamalludin Harun, and Prof. Dr. Baharuddin Aris

Faculty of Education,
University of Technology Malaysia,
Skudai, Johor, Malaysia

ABSTRACT

One of the promises of Intelligent Tutoring System (ITS) is that it will teach and assist learning in an intelligent manner. It tracks student's performance and uses the information to provide suitable instruction and teaching material to each student dynamically to best help them learn that domain. ITS critiques are focused on queries whether tactics that are effectively applied by human teachers can be as effective when embodied in machine teachers against students' preferences based on their learning orientation, experience, motivational state, and etc. This paper proposed a conceptual model that integrates four different stages of student learning orientation in an ITS for tutoring students according to their needs, viz, Stage 1 : High Pedagogy / Low Andragogy, Stage 2 : High Pedagogy / High Andragogy, Stage 3 : Low Pedagogy / High Andragogy and Stage 4 : Low Pedagogy / Low Andragogy. Particularly, student at stage 1 will be taken to a guided learning environment while students at stage 3 preference will be more self-directed with the machine tutor acting as a facilitator. Hopefully, if this model were considered when developing an ITS, the machine teachers can be as effective as the human teachers.

1.0 Introduction

Before the intelligent tutorial systems came into existence, the attempts were made to use computers in teaching process by Computer Aided Instruction or Computer Based Learning. Then, Web Based Learning become popular with the advance of the Internet technology since people saw its great potential in sharing information among students and educators. Web based courses may provide static pages such as printed course materials or other dynamic activities like discussion forums, videoconferencing, and even live lectures (video streaming) (Judy McKimm *et. al*, 2003). Their benefits are that a student able to navigate through the material on their own pace plus it is highly interactive.

However, when using computer for teaching and learning purposes, it is important to create the system in such a way to be adaptive with the student capabilities and their overall performance. CAI or WBL shortcoming was lack of individualization. Yong & Zhijing (2003) pointed out that many web based education systems is just electronic books with limited interactivity and diagnostic capability. In order to create a teaching and learning environment on computer that adoptable to the learner performance and capability, Intelligent Tutoring System comes in handy.

2.0 Intelligent Tutoring System

Intelligent tutoring system whether based on CD-ROM or internet have the ability to present teaching material in a flexible way that imitate the human teacher process of one-to-one tutoring (Yong & Zhijing , 2003). It takes into consideration about what to teach, the way to teach and the relevant information about the student being taught.

Intelligent tutoring system is term, encompassing any computer program that contains some intelligence that provides direct customized instruction or feedback to students adaptively during the teaching and learning process (Freedman, 2000). Intelligent Tutoring System had come into existence since mid-seventies and still being considered in the current educational research. This research area amazingly attract so much sponsorship from government funding organisations in different countries untill nowadays (Kinshuk, 2002). A typical model of an ITS consist of three main components: the domain modules, the student module, and the tutor module (Siemer & Angelides, 1998). The function for each module are as follows:

Student Module : It includes the student's specific information regarding their preference, cognitive level, and etc that will create the individualization of the tutoring (Beck *et al.*, 1996; Siemer & Angelides, 1998).

Domain Module: It contains information about the domain knowledge, which is the facts, procedures or concepts to be taught from the lowest level to the toughest level (Siemer & Angelides, 1998; Thaw & Somnuk ,2005)

Tutor Module: It contains a planner with rules to decide teaching strategies adaptive to the student's action (Thaw & Somnuk ,2005; Siemer & Angelides, 1998; Freedman, 2000).

ITS had been widely develop and used in varies principal to enhance students performance. Various evaluation studies comfirm that individual students can benefit in their learning process using ITS (Ong & Ramachandran, 2000; Kinshuk, 2002; Shahliza Abd Halim et al., 2006; Robert et al., 2001).

However, many of the earlier ITS just consider the student background in term of their performance level or cognitive state for the system to decide the next difficulty level and depth of the topic should be offered (Ong & Ramachandran, 2000; Freedman, 2000). Still, students with equal cognitive level does not meant that they process and represent knowledge similarly. This is because, students have different learning preference including the type of instruction to which they respond best, the way they approach their individual studies, their perception about the nature of knowledge and even their own role in constructing their learning.

Successful human instructors know that they can make a huge difference in the classroom with personalized attention, particularly in recognizing and tapping into how individuals may need to learn differently. In earlier ITS, these factors may be overlooked. In order to ensure that the system even more beneficial and adaptive to the student needs, students learning orientation or preference must be considered.

2.1 Pedagogy versus andragogy orientation

The pedagogical model has been the prevailing learning model in the education of children since the 19th century. In this model, the learning orientation of a student is

centered around the subjects studied, content of the instructional materials, and teacher experiences that are required to reach their academic goal, and any learning motivation that they possess usually comes from an external source like grades. Educators play a big roles in this theory in order to make a decision on when their students are ready to absorb new ideas, subjects or practices and when to move forward to the next level in their education (Knowles et *al.,* 1998).

The andragogical model on the other hand specifically oriented toward the adult learner. Andragogy, initially defined as "the art and science of helping adults learn," by Knowles (1970). It is the process of engaging learners in the structure of the learning experience. Knowles state that children and adults learn differently, and for different reasons.

The pedagogical model and andragogical model differ in six assumptions about learners which are the learner's need to know, self-concept, experience, readiness to learn, orientation to learning, and motivation (Knowles et *al.* 1998). Table 1 summarizes the differences between the pedagogical and andragogical models:

Table 1 – Pedagogical and Andragogical Assumption about Learners

No.	Aspect	Pedagogical Model	Andragogical Model
1.	Need to know	Learners need to know what the teacher tells them.	Learner need to know why something is important prior to learning it.
2.	The learner's self concept	Learner has a dependent personality.	Learners are responsible for their own decisions.
3.	The role of the learner's experience	The learner's experience is of little worth.	The learner's experience has great importance.
4.	Readiness to learn.	Learners become ready to learn what the teacher requires.	Learners become ready to learn when they see content as relevant to their lives.
5.	Orientation to learning	Learners expect subject centered content.	Learners expect life centered content.
6.	Motivation	Learners are motivated by external forces.	Learners are motivated by primarily by internal forces.

Source: Knowles et al. 1998

However, Knowles (1980) revised his statement that andragogy is not only for adults learner. Andragogy can be used alongside the pedagogical model of assumptions that suitable to a particular situations since that he receive varies report that applying the concepts of andragogy to the education of youth might produced superior learning.

2.2 Orthogonal association between andragogy and pedagogy

Research conducted by Delahaye et *al.* (1994) then found that learners could be two dimensional, utilizing both pedagogical and andragogical principles at the same time. Delahaye et *al.* (1994) had injected the finding of the orthogonal association between

andragogy and pedagogy of their research into the work of Stuart and Holmes (1982). They form model of four stages of learning as shown in Figure 1.

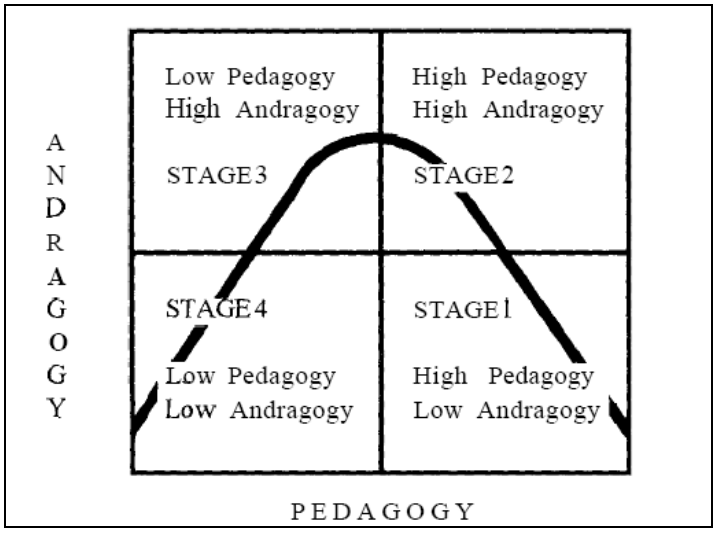

Figure 1 Four stages of learning (*Source:* Delahaye et *al.*, 1994)

The orthogonal representation of andragogy and pedagogy embraces a more holistic awareness of learning orientation in four stages underpinned by learner maturity. This model parallels Grow's (1991) four stages of self-directed learning. As stated by Knowles (1980), personal traits analogous to maturity also play an important part for transformation from low to high self-directedness.

Stage 1 in the learning model represents the interpretation of pedagogy orientation model while Stage 3 describes that of andragogy learning orientation. Stages 2 may be visualized as a partial stage where student prefer pedagogical as well as andragogical orientations to study. Stage 4 may be best visualized as only involving the learner without the assistance of a teacher or facilitator (Choy and Delahaye, 2003)

Research done by Choy and Delahaye (2002) among 266 young people aged 17 -24 years and enrolled in VET programs initiate that youth preferred pedagogical as well as andragogical practices. Choy and Delahaye (2003) also found that youths (aged 18 to 24) were surface learners with low readiness for self-directed learning but prefer a combination of structured and unstructured learning. They suggest youth learners are at Stage 2 in the four stages of learning development.

2.3 Aplication of pedagogy and andragogy orientation

Range of knowledge acquisition for the student module of ITS remains a difficult problem, partly because of the complexity associated with understanding both how people learn and how it is best to tutor (Cheung et *al.* 2003). In the past, explanations of differences in the ways that people learn have focused on cognitive factors having to do with thinking and information processing, such as learning styles. However, that

is not the only key sources for individual learning differences. Pedagogy or Andragogy model is actually crucial assumptions about the characteristics of learners that consider the whole-person perspective in term of diagnosis of needs, learning climate, and role of their experience.

Giving this into hand, an appropriate learning orientation such as Pedagogy or Andragogy should be considered when developing an Intelligent Tutoring Systems. Since that the ITS will be used independently, the level of student self directedness might influence their learning experience and performance. However, as we had acknowledge earlier that there are learners that preferred both pedagogy and andragogy principles, than the four stages of learning model formed by Delahaye et *al.* (1994) is applicable . The orthogonal relationship of pedagogy and andragogy grant an opportunity for new learning orientations, and instructional strategies which should be considered to create better personalized learning.

The distinctiveness of each learning orientation stages create an implication to the ITS model. Table 1 will describe briefly the description of learners and some of their implications for learning preferences.

Each individual level of pedagogical and andragogical orientation will be identify by the Intelligent Tutoring System and stored in the Student Module. This level will then become an input to the rules applied in the Tutor Module to decide which stages of learning orientation should be considered; Stage 1 : High Pedagogy / Low Andragogy, Stage 2 : High Pedagogy / High Andragogy, Stage 3 : Low Pedagogy / High Andragogy and Stage 4 : Low Pedagogy / Low Andragogy. At the same time, the deepness of the knowledge domain offered to the student will be delivered accordingly.

Table 2 Learners characteristics under 4 stages of learning orientation

	Learners Description	**Learning Preferences**
Stage 1 : High Pedagogy / Low Andragogy	- They are dependent learners - They need directions on what to do, how to do it, and when.	- Coaching with immediate feedback. Drill. Informational lecture. Overcoming deficiencies and resistence. - Evaluation by teacher.
Stage 2 : High Pedagogy / High Andragogy	- They are dependent learners with a moderate level of self-directedness - They respond to motivational techniques. - They are willing to do assignments they can see the purpose of.	- Inspiring lecture plus guided discussion. Goal-setting and learning strategies. - Evaluation by teacher.
Stage 3 : Low Pedagogy / High Andragogy	- They see themselves as participants in their own education. - They will even explore some of it on their own. - They may learn to identify and value their own experiences in life. - They may learn to value the personal experiences of others.	- Discussion facilitated by teacher who participates as equal. Seminar. Group projects. Inquiry Projects, Experiential Techniques. - Evaluation by learner-collected evidence, criterion referenced
	Learners Description	**Learning Preferences**
Stage 4 : Low Pedagogy / Low Andragogy	- They set their own goals and standards - They use experts and other resources to pursue these goals. - Highly social. - Highly Self-directedness. - Able and willing to take responsibility for their learning.	- Internship, dissertation, individual work or self-directed study-group. - Evaluation by learner-collected evidence, criterion referenced

(Source: Delahaye et al., 1994; Grow, 1991; Knowles et al., 1998)

3.0 Conclusion

This new design model of ITS will be able to explain the core knowledge of topic chosen, suggest the appropriate learning strategy to deepen students understanding, and suggest the next most efficient activity for the student in their own personalized learning environment based on four stages of learning orientation based on Delahaye et al. (1994). Hopefully, if this model were considered when developing an ITS, the machine teachers can be as effective as the human teachers.

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