Enriching Blended Pedagogy through Piagetian Learning Model:
A Case Study

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Abstract: Teaching and learning process is one of the important components in the principles of effectiveness for serving adult learners as proposed by Council for Adult and Experiential Learning, US. The exemplary practices of this teaching and learning process can be implemented through various strategies by an university specialized in open & distance education or e-learning. This paper discusses of how blended learning pedagogy coupled with Piaget model can be designed to support the teaching and learning process in the distance education. Our aim to incorporate Piaget learning thoughts in blended pedagogy is to promote the cognitive development of the learner that will lead to the good understanding of a technical or computing subjects.

Keywords: Distance Education, Blended Pedagogy, Piagetian Learning Theories

Introduction

Open and distance education (ODE) and e-learning are fast becoming the way of providing education to the masses. ODE and e-learning give opportunity for the working adults to enroll in programs that match their interest without leaving their job. Serving adult learners are more challenging than serving in-campus students. According to CAEL (Council for Adult and Experiential Learning, US), there are eight principles of effectiveness for serving adult learners, namely outreach, life and career planning, financing, assessment of learning outcome, teaching and learning process, student support systems, technology and strategic partnerships. We consider the *Teaching-Learning Process* in the principles of effectiveness for serving adult learners as the most important element in imparting knowledge to a student. In addition, CAEL has listed six exemplary practices to support this teaching-learning process for the adult learners. We consider the following two exemplary practices of teaching and learning process as the most important especially in imparting knowledge to the adult learners:

1. Employs a teaching-learning process that includes a high degree of interaction among learners and between learners and faculty.
2. Considers adult learners to be co-creators of knowledge.

Source: CAEL

In this paper, we will discuss how we have enriched blended pedagogy using Piagetian learning model to support the above two exemplary practices of the teaching-learning process of technical/computing subjects. Piaget has made two major contributions to the understanding of cognitive development: the stages of learning and how knowledge is acquired through assimilation and accommodation processes. Although Piaget research was focusing on children, but many of his theories can be applied for adult learners.

Piaget Learning Theories

The following two subsections elaborates on two   major contributions from Piaget learning theories: stages of learning and acquiring knowledge.

Stages of Learning

Piaget stages of learning is divided into four levels as shown in the table below (Sutherland 2005):

	Stage	Constituent
1	Sensori-motor activity	Babies
2	Pre-operational stage	Toddler
3	Concrete operational stage	Primary schools, lower secondary
4	Formal operational stage	Post-16 education

Table 1: Stages of Cognitive Development in Piaget Learning Theory

Many adult educators have assumed that Piaget regarded all adult learners as formal operational thinkers (Sutherland 1999). If this is the case, adult learners should be capable in the domain that they are not proficient (Sutherland 2005). Research has indicated that not all adult learners are belong to formal operational stage (Sutherland 1982). Therefore a proportional of adults are still at concrete operational stage (Sutherland 1999). If this is the case, it will pose problems for the educators as they cannot assume that all their students are at formal operational stage. Adult educators should accept the fact that there are students operating at concrete operating stage and be more flexible in helping this category of student in the transition from concrete operational level to formal operational level (Sutherland 2005). This has brought new implications to the adult educators: how to find ways to address this phenomenon (Sutherland 2005). Educators should strive to raise their concrete level students into formal operational stage. This can only be achieved if students acquired some form of knowledge. In order to achieve this, Piaget has proposed two theories: assimilation and accommodation.

Acquiring Knowledge

Piaget has introduced many theoretical notions in his learning model. The two major theoretical notions that explained how knowledge is acquired are assimilation, and accommodation (Hergenhahn and Olson 2001). Assimilation means kind of matching between the learners' cognitive structure and the physical environment. Having only *assimilation* is not effective as the learners are only assimilating the experiences into their existing cognitive structure (Hergenhahn and Olson 2001). Second concept which is important for the learners intellectual growth is *accommodation* which is the process by which the cognitive structure is modified (Hergenhahn and Olson 2001). According to Piaget learning model, if assimilation were the only cognitive process, there would be no intellectual growth because a learner would simply go on assimilating its experiences into its cognitive structure (Hergenhahn and Olson 2001). Both assimilation and accommodation should present in order to raise the intellectual growth of the students.

Piaget has referred assimilation and accommodation as functional invariants as they occur at all levels of intellectual development of a learner (Hergenhahn and Olson 2001). It is interesting to note that early experience tend to involve more accommodation than later experiences because more and more of what experienced by a student will correspond to existing cognitive structures, making accommodation less important as the student progresses (Hergenhahn and Olson 2001). At any stage, the learner learns by the complimentary processes of assimilation and accommodation (Sutherland 1999) but the intellectual growth only happens when they student is in an equilibration mode.

Achieving Equilibration

Another theoretical notion that closely related to assimilation and accommodation is equilibration as shown in the following figure:
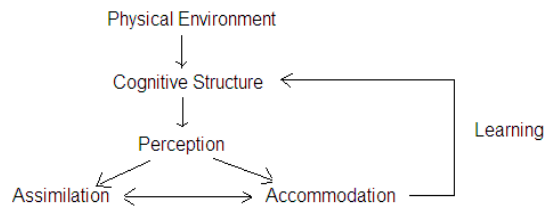
Figure 1: Reaching Equilibrium through Assimilation and Accommodation Processes (Hergenhahn and Olson 2001)

   Piaget assumed that all students will have a tendency to create a harmonious relationship between their peers and the environment in order to achieve maximum adaptation or equilibration (Hergenhahn and Olson 2001). Equilibration involves both assimilation and accommodation. During the stages of development, people use certain logical internal mental structures that allow them to make sense of the world. When external reality does not match with the logical internal mental structures, then the person is in disequilibria stage. This imbalance will cause equilibration occurs as an effort to bring balance between assimilation and accommodation as the person adapts more sophisticated internal mental structures (Hergenhahn and Olson 2001). This effort to maintain a balance, denoted by equilibration, allows for cognitive development and effective thought processes. The dual processes of assimilation and accommodation along with the quest to be in the equilibration stage provide an opportunity for the intellectual growth of the student (Hergenhahn and Olson 2001).

Applying Piaget Model of Learning in Blended Pedagogy

Educators utilizing the Piagetian learning concepts should raise the concrete operational student to the formal operational stage and at the same time help students in formal operational stage when they are facing in in-equilibrium situation. The Piagetian theories imply that different teaching should be provided to the students according to their operating stage within a single institution (Sutherland 2005). However, in distance education, the educators do not have the luxury to customize their teaching according to their student's stage. This will lead to implication for the researchers: how to find technique which can help the educators to handle the situation? In our implementation in order to answer the question, we have adopted blended pedagogy to execute the Piagetian learning notions. Blended pedagogy is chosen as it is able to address multiple perspectives of Piaget learning theories as well as giving us the platform to deliver richer set of learning strategies that can be blended in various forms to the various stages of the adult learners (Singh 2003). The term "blended learning" (BL) has gained considerable interest in recent years as a description of particular forms of teaching combined with technology (Dzakiria, Mustafa, and Abu Bakar 2006). The following figure shows of how we have envisioned the utilization of Piaget learning theories for adult learners in blended pedagogy mode.
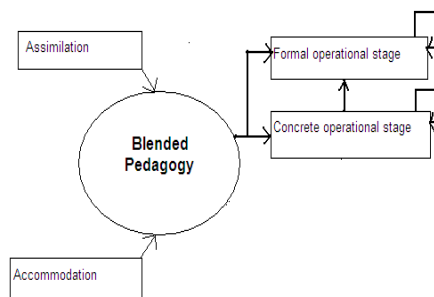
Figure 2: Using Blended Pedagogy to Implement Piaget Learning Theories for the Teaching and Learning of technical/computing subjects through Distance Education

In our implementation, the components that make up blended learning are: online learning, face-to-face tutorials and self-managed learning. Each of these components will be executed using various established techniques. Figure 3 is the extended version of Figure 2 which shows how the main components of the blended pedagogy and their respective execution methods fit into the proposes Piaget Learning model.
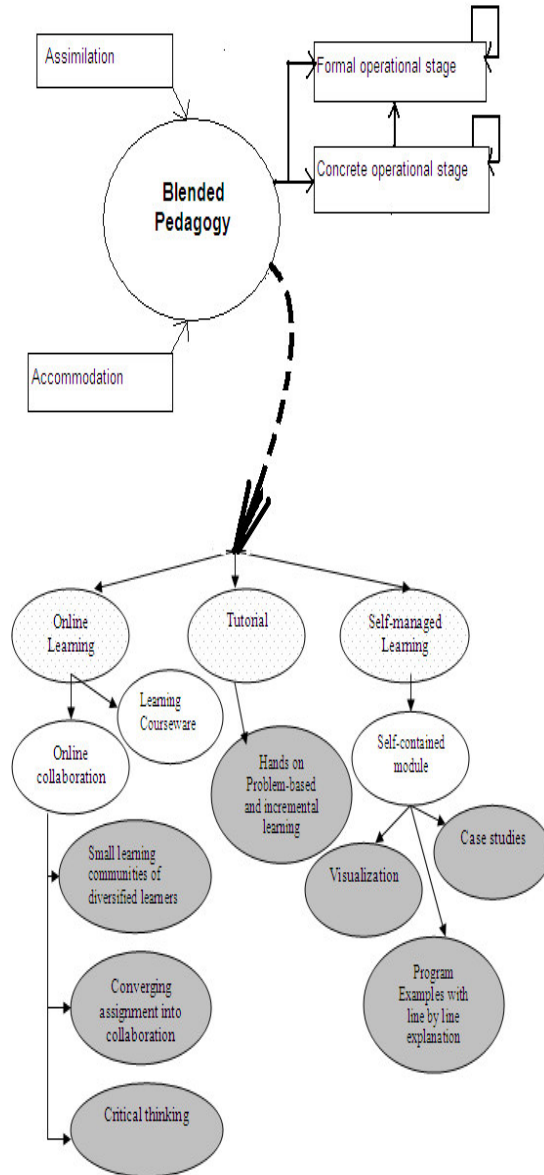
Figure 3: Extended Version of Figure 2 that Shows the Execution Techniques in Utilizing Piagetian Learning Theories

The unique approaches employed in all the execution methods are highlighted in grey oval in the above diagram. Each of this execution method will correspond to either accommodation or assimilation dimension of the Piaget learning model as shown in the following table.

Blended Pedagogy		
Category	**Execution Method**	**Corresponding Piaget dimension**
Online Learning	Small Group Online Collaboration	Accommodation
	General Online Discussion	Accommodation
	Learning Courseware: Recorded online lectures, FaQs on Java, Learning Objects	Assimilation
Face-to-face meeting	Tutorial	Assimilation
Self-managed Learning	Self-contained module	Assimilation

Table 2: Execution Methods of the Blended Pedagogy and their Corresponding Piaget Dimension

Discussion and Concluding Remark

In this paper we have proposed a framework to implement Piagetian learning theories for the purpose of teaching and learning of technical/computing subjects through distance education. We have proposed blended pedagogy as a mean to execute the proposed model and in doing so, we have incorporated work done by others which were done in isolation. The framework is expandable by incorporating (plugging-in) other various techniques as long as it fits into the framework and addresses the assimilation or accommodation perspective of Piagetian learning theories. In this framework it is assumed that the student will do self assessment to determine their operating stage of cognitive development. However, we agree that this may not very practical as the student may not monitor their own performance effectively. We are currently investigating of how an intelligent agent can be developed to determine in which level a student is operating and whether they are in equilibrium stage or vice versa. Based on the outcome, the agent can perform some pro-active activities to help the students. Piaget learning theories has its own weaknesses as highlighted by Sutherland (1999) and Hergenhahn and Olson (2001). Nevertheless, Piaget learning theories has his own strength as it involves both acquisition of information and cognitive representation of the

information and the identification of qualitative aspects of learning (Hergenhahn and Olson 2001) which is relevant for technical and computing courses.

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