

## **Animated pedagogical agent to improve learning outcomes in computer based instruction**

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**Abstract:** Students learned the heart function with pedagogical agent who perceived as the mentor during the instruction. The study aimed to explore the effects of agent properties(agent with verbal hints , agent with visual hints, no agent)with measuring the learning outcomes using four criterion tests(drawing test, identification test, terminology test and comprehension test) .The results support the cognitive and multimedia learning theories. With the pedagogical agent standing next to verbal or visual explanations along with visual instruction, students performed better than text only and pedagogical only. Furthermore, the study also portrays the notion of scaffolding design of multimedia learning environment.

**Keywords:** Pedagogical agent, animation, scaffolding

### **Introduction**

The notion of scaffolding has been succeed for facilitating learning. And, it has extended to the design of scaffolding in the hypermedia environment. The design of scaffolds and impacts are emerged with hypermedia environment. Current research has showed the idea of scaffolding has been adopted in technology for supporting learning by animated agents. However, how to design an animated pedagogical agent fostering constructivist learning in a computer based learning environment for complex ideas? To address this issue, evolving the idea of the cognitive apprenticeship is a new concept for designing the scaffolding for multimedia learning environment. The animated pedagogical agent is embedded in the subject content domain. The relationship between pedagogical agent and students can be best described as cognitive apprenticeship. In support this concept, Collin, Brown and Newman(1989) proposed there are six functions of the cognitive apprenticeship that the mentor can provided for students while learning or performing the tasks. Later, Chee(1994) divided six functions as three main ideas, the first main idea is modeling, coaching and scaffolding is supported students to acquire the interrelations of concepts. While learning complex concepts, students can observe the expert explaining the task and build a concept model for concept assimilation and internalization. Additionally, the pedagogical agent has the flexibility for providing interactive demonstrations on verbal/visual hints. Through the coaching process, the conceptual knowledge is built step by step with verbal or visual hints which the agent presented.

### **Initial Design Framework**

The purpose of the design was aimed to make connections from abstract concepts to the concrete representation for students. To illustrate it, learners are given a series of learning episodes that specify human heart function. Each episode introduced various parts of the

heart along with static picture, and hints from pedagogical agent. The pedagogical agent was embedded in the frame that provides verbal or visual hints. While learners read the instruction, they can ask for pedagogical agent for explicitly assistance. Two types of hints are provided, when learners can't grasp the main idea of the instruction, they can ask the pedagogical agent for verbal hints. Second, if learners want to comprehend the lesson with visual aid, they can ask pedagogical agent to display the visual hint. Alternatively, experienced learners can choose comprehend the lesson without extra hints. The design of the scaffolding was adopted the concept of cognitive apprenticeship as well as targeted as a learner –centered design for students who can control their own learning strategies.

### **Research design**

The study is designed to examine the effectiveness of the animated agent providing the instructional explanations. Specially, the focus will be the presence of the animated agent with verbal or visual hints. Thus, the experiment will be addressed two questions: a) Do students perform better when the animated agent is presented with verbal hints than only the text only condition? b) Do students perform better when the animated agent is presented with visual hints than the text only condition?



Figure 1: *Example of Pedagogical agent*

### **Pilot study results**

The first pilot study was conducted before the official study was investigated. The purpose of the pilot study was to understand the level of students' prior knowledge and difficulties for human heart function in order to introduce the appropriate treatments. The result indicated that 22 out of 40 items need to embed the instructional treatments. Table 1 shows the result of the item analysis of the first pilot study.

Table 1: *Item analysis for the first pilot study*

Comprehension test item	Item difficulty	Terminology test Item	Item difficulty
1	42	1	38
2	25	2	53
3	42	3	77
4	25	4	50
5	58	5	54
6	0	6	38
7	50	7	62
8	50	8	8
9	50	9	69
10	67	10	38
11	75	11	23
12	33	12	38
13	42	13	46
14	50	14	46
15	25	15	69
16	58	16	46
17	58	17	23
18	33	18	46
19	33	19	85
20	50	20	47

Table 2: *Mean and Standard deviation in the first pilot study*

Measures	Mean score	Standard deviation
Comprehension test	8.59	3.85
Terminology test	9.62	4.11

**Further work**

The initial design and item analysis helped identifying the problem and implied improvement for some of the learning episodes. . Therefore, two treatments are designed and implemented scaffolding system approach which can bridge the novice and experienced learners for comprehend the human heart function.

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