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Application of Madeline Hunter Model in Mathematics Learning Courseware

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***Abstract*—Due to concerns about the effective teaching method for mathematics subject, the authors adopted the Hunter Model in order to teach students for topic Line and Angle. This method was implemented in the developed mathematics learning courseware. The 8 steps of this model were designed in the courseware systematically from the beginning until the end of the lesson. Therefore, this paper discusses the application of Madeline Hunter Model in the developed courseware.**

Keywords-component; Madeline Hunter Model; courseare; Line and Angle.

I. INTRODUCTION

Nowadays, educators take opportunities to harness the power of computer technology in helping students to learn mathematics. Interactive courseware has integrated in teaching as its potential to solve the constraint of using traditional media and provide learning environment with visual component [1]. So, the use of CBL as a teaching tool has become common in Malaysian schools. The Malaysian government sees the benefits of integrating courseware in teaching. According to Curriculum Development Centre Ministry of Education Malaysia (2004), technology in education supports the mastery and achievement of the desired learning outcomes.

II. MADELINE HUNTER DIRECT INSTRUCTION MODEL

Madeline Hunter described seven-step lesson plan in her published book, Mastery Teaching. This approach is known as the "Madeline Hunter Method" or the "Madeline Hunter Direct Instruction Model. " [2]. Direct Instruction is cognitive learning [3]; [4]; [5]. Sutton and Seifert [6] claim that the organisation of direct instruction are based on two learning theories, they are behaviorism and cognitive. In accordance with behaviorism, for instance, when students provide a correct answer, the instructor praises them immediately. In contrast, in accordance with cognitive theory, the instructor states the learning objectives prior to teach them, gives reviews of materials and monitor on students' learning progress. Besides, the instructor teaches in small steps, provides students plenty of time to practice.

Madeline Hunter Model is a method mostly used in designing a lesson planning. This model can be related with behaviourist or cognitivist instructional design models [7]. This research applied Madeline Hunter direct instruction in keeping with cognitive theory. Therefore, the Mathematics learning courseware states learning objectives and presents the material in small steps.

The model has been published for more than 20 years. But, it still has currency in learning design today [2]. Hunter Model was developed to design lesson for plan primary or secondary school where the context of the subject matter is simple and the learning process is in short period [8]. However, in fact, Hunter [8] claims that this model is also effective for university teaching. Steward, *et al.* [9] claimed that the model is an approach that significantly improves student's learning. This model is never intended to be strictly linear. They can also be eliminated if they are not relevant to the learning process [10]. The steps stated in Laura, *et al* [11] has the most steps. However, Laura, *et al* [11] was chosen though not all the elements have to present for an effective lesson (refer to TABLE I)

TABLE I. THE MADELINE HUNTER MODEL

Step	**Description**	**Example phrase**
Anticipatory set	Teacher provides a hook for students to relate the relevance experiences of the students to the learning subject matter.	"Last time we." "Today we will…"
Objectives /Standards	Students specifically identify the learning objective they will be able to achieve in the end of the lesson.	"By the end of this lesson, you will know and be able to…"
Teaching /Input	The facts, skills, concepts, and principles the instructor which are expected as the end product of the learning will be imparted to the students in this step.	"Here are the ideas…"
Modeling	A model or example is provided which is expected as learning outcome.	"This is how…"
Guided practice.	Teacher provides direct guidance as students practice exercises or do activities which relevant to the subject matter.	"Try this example and I'll help…"
Check for understanding	Teacher evaluates the students' achievement to ensure that they have achieve the learning objective/s.	"What did I say was the most important…"
Independent practice.	Students redo the practice for reinforcement of the learning after they have acquired the learning	"Take this case home with you…"
Closure	Clues in action or words form are provided to students what they have	"Please think about the

	learned.	essentials of today's lesson and prepare to tell the group what you think it was about."

Source: Burns [2]; Hansen, *et al*., [11]

III. IMPLEMENTATION OF MADELINE HUNTER MODEL

Objective of this study is to develop a Mathematics learning courseware. Topic Line and Angle was chosen to be taught. Mitchelmore and White [12] claim that students' regard this topic is difficult to learn because of the multifaceted nature of angle and also it require a general concept of angle. Besides, they find hard to see the similarities between the various angle contexts and identify their essential common features [12]. In fact, this topic is the basic mathematics skill for learning geometry [13]. So, the steps in Madeline Hunter Model were implemented in the courseware in order to learn the topic of Line and Angles. The following is the screen captures of the courseware which follow the Madeline Hunter Direct Instruction.

A. Anticipatory set

The purpose of this step is to establish the relevancy of the instruction to the students. Therefore, the figure of a cake was used at the beginning (Figure 2). Then, the cake's colour is faded and the students are required to focus on the missing part that is highlighted in red colour (Figure 3). Therefore, instructor relates the missing part of the cake with angle.

Figure 1. Cake was used as the example that relate to students' dailylife

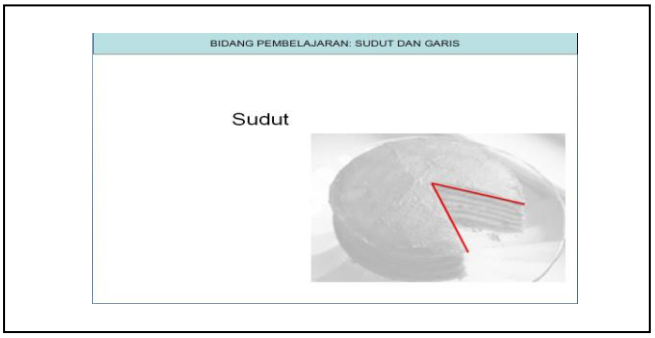

Figure 2. Relation between the missing part of the cake with an angle

B. Objectives and purpose

This step informs the students what they will be expected to do as a result of the instruction. It is only a few words in order to reduce students' cognitive load.

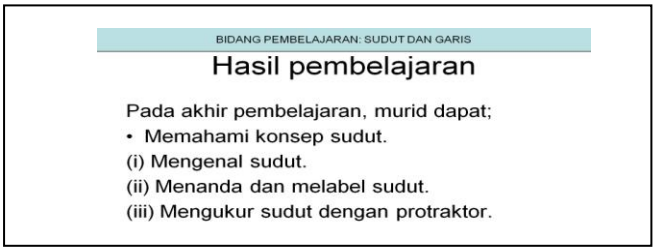

Figure 3. Informs objective and purpose

C. Input

The input step is the dissemination of new information, which is necessary to achieve the stated objectives. At this step, animation of moving clock was used as one of the reusable learning object to explain the concept of rotation.

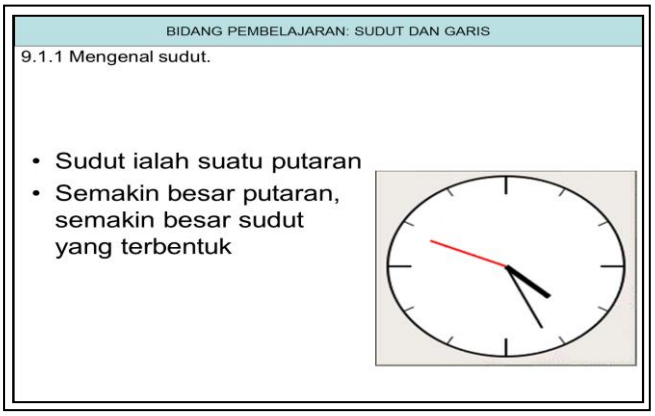

Figure 4. Animation of clock to show the concept of rotation

D. Modeling

At this step, instructor needs to explain the content with demonstration which sometimes with an example of the acceptable finished product or process.

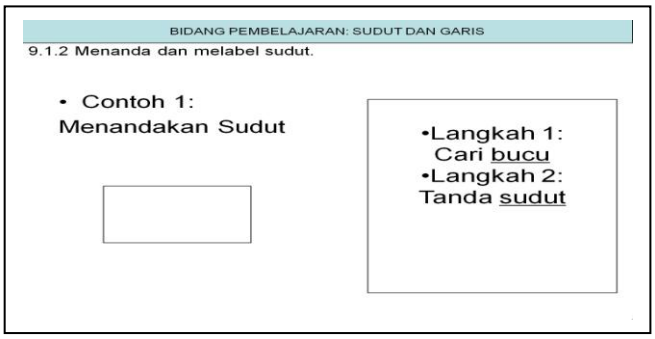

Figure 5. The step by step demonstration to find and label an angle

E. Checking for understanding

At this stage, instructor examines the students' possession of essential information that achieves the stated objectives. First, instructor shows the question and asks students the next step of solving it. Then, instructor examines students' understanding through their feedback and response. After that, instructor gives feedback immediately after students' response.

Figure 6. The "checking for understanding" step

F. Guided practice

During this step, instructor asks students to answer a question as a practice for the concept. Students need to answer the question by their own and using their understanding. Instructor guides the students when they answer it wrongly and instructor will also praise the students when they answer it correctly.

Figure 7. Students' first task

G. Guided practice

This step is a continued practice of the whole task by the student without the teacher's monitoring and guidance. This step also give reinforcement for student to understand the concept.

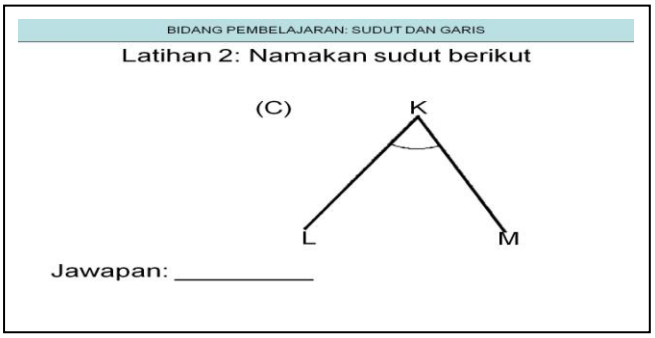

Figure 8. Students' reinforcement task

H. Closure

Lastly, instructor concludes the lesson and provides cues to students that they have learned the subject matter.

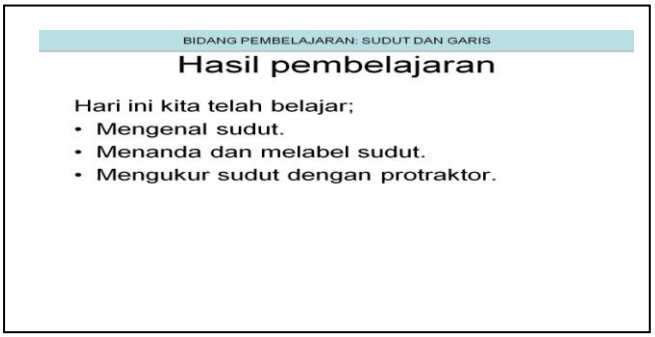

Figure 9. "Closure" step

IV. METHODOLOGY

Quasi experimental design is chosen in this research. In other words, the respondents are not chosen randomly from all the respondents as computer and LCD projector should be available in the school for teaching and learning using CBL-Math and the number of Form One students is sufficient. In this phase, the developed Mathematics

learning courseware, namely CBL-Math, is implemented to the 60 students who are Form 1 from a school located in Johor. There are 30 of the students in control group and the other 30 of them in treatment group. The control group was taught by using conventional teaching method. The students who are in treatment group were taught by using CBL-Math.

V. DATA ANALYSIS AND RESULTS

To begin with, the data obtained for both pretest and posttest were evaluated for normality. To access the normality of the data, Shapiro-Wilk test was used. After that, a paired sample t-test was administrated to determine the different between the mean of the pretest scores with the posttest in both groups whether significant or not. TABLE II and TABLE III illustrate the results obtained from both Kolmogorov-Smirnov and Shapiro-Wilk test.

TABLE II RESULTS FOR THE NORMALITY TEST IN CONTROL GROUP

	Kolmogorov-Smirnov (a)			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig
Pretest	0.122	30	0.200	0.939	30	0.087
Posttest	0.133	30	0.182	0.946	30	0.130

TABLE III RESULTS FOR THE NORMALITY TEST IN TREATMENT GROUP

	Kolmogorov-Smirnov (a)			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig
Pretest	0.127	30	0.200	0.962	30	0.353
Posttest	0.159	30	0.050	0.951	30	0.181

From the results, the significant value for Shapiro-Wilk in control group indicates that the pretest and posttest data were respectively 0.087 and 0.130. The significant values in treatment group were 0.353 and 0.181. Kolmogorov-Smirnov test was administrated but the result was not employed as the number of samples in this research was only 30 [14]. If the values were greater than .05 in the both test, then the data were considered as normally distributed. The results (TABLE II and TABLE III) indicate that the significant values of pretest and posttest in both group which were greater than 0.05 (chosen alpha level). So the data in both groups were considered as normally distributed.

After the normality of the data being tested, paired sample t-test was administrated to compare the mean scores between the pretest and posttest. TABLE IV presents paired samples statistics table for the pretest and posttest in control group. TABLE V shows paired samples statistics table for the pretest and posttest in treatment group. The significance value should be less than 0.05 to indicate a significant difference [15]. Both tables indicate the significance value is 0.000, where the p-value is less than 0.05 ($p < 0.005$). Therefore, the results show that both teaching method have significant difference.

TABLE IV. PAIRED SAMPLE STATISTIC TABLE FOR PRETEST AND POSTTEST IN CONTROL GROUP

	Paired Differences					t	df	Sig. (2 tailed)
	Mean	Std Deviation	Std Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre Cont-Post Cont-	-9.500	5.144	0.939	-11.421	-7.579	-10.114	29	0.000

TABLE V. PAIRED SAMPLE STATISTIC TABLE FOR PRETEST AND POSTTEST IN TREATMENT GROUP

	Paired Differences					t	df	Sig. (2 tailed)
	Mean	Std Deviation	Std Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre Treat-Post Treat-	-20.667	8.976	1.639	-24.018	-17.315	-12.610	29	0.000

Since, both control and treatment group show significant different in their tests, the posttest result of treatment and control group were analyzed using independent t-test. TABLE VI presents the descriptive analysis of treatment and control group. It shows that the mean for treatment group which is learned using CBL-Math was higher than control group. Moreover, TABLE VII presents the results of independent samples t-test.

TABLE VI DESCRIPTIVE STATISTIC

	IVScore	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
DVSco	Treatment Group	30	62.33	25.146	4.591
	Control Group	30	43.50	22.212	4.055

TABLE VII. INDEPENDENT SAMPLES T-TEST

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
DVSco	Equal variances assumed	0.382	0.539	3.075	58	0.003	18.833	6.126	6.572	31.095
	Equal variances not assumed			3.075	57.13	0.003	18.833	6.126	6.568	31.099

Before independent t-test was administered the Levene test was run for testing equal Variances [16]. If the Levene test's result is statistically significant (the result has a p-value more than 0.05), it means that the data shows homogeneity of variance. Otherwise, if the test result has the p-value of less than 0.05, it means that the data do not show that the variability is about the same. In this research, results (refer to TABLE VII**)** show the significant value is 0.539 which is more than 0.05; it means that the variables are homogeneous. As the data shows homogeneity, therefore, an independent samples t-test can be applied on it [17].

The test was conducted to compare the students' score marks in post test. The results indicate significant difference in the scores for students who were using CBL-Math (M=62.33, SD=25.146) and students who were not using CBL-Math (M=43.50, SD=22.212) conditions; t (58) =3.075, p = 0.003 (refer to TABLE VII). These results suggest that CBL-Math does have an effect on enhancing students' achievement.

VI. CONCLUSION

This paper has demonstrated on how the principles of Madeline Hunter Model are used for designing learning materials. The developed course were followed the 8 steps listed by Madeline Hunter in order to teach students the topic of Line and Angle. The following steps help educators develop effective lesson plan and also support students to understand the whole concept from the beginning until the end. Thus, further research conducted to investigate the effectiveness of the developed courseware on students' achievement. The results and data are presented in the form of tables and figures to make the content can be understood easily. To sum up, the developed CBL-Math which implemented the Madeline Hunter instruction model give significant influence on students' achievement and also understanding for topic Line and Angle.

References

[1] K. Norfadilah, "Challenges of malaysian developers in creating good interfaces for interactive courseware," TOJET: The Turkish Online Journal of Educational Technology – January 2010, volume 9 Issue 1.

[2] A. C. Burns, "Teaching experientially with the madeline hunter method: an application in a marketing research course," Developments in Business Simulation and Experiential Learning. Louisiana State University, Volume 32, 2005.

[3] M. A. Kozloff, and F. B. Bessellieu, "Direct instruction is developmentally appropriate," Wilmington, NC: University of North Carolina, Watson School of Education. April 2000.

[4] W. Becker, S. Engelmann, and D. Thomas, "Teaching: a course in applied psychology," 1971.

[5] S. Engelmann, "Conceptual learning. San Rafael, CA: Dimensions Publishing Company.

[6] R. Sutton, and K. Seifert, "Educational Psychology," Global Text. Zurich, Switzerland, 2008.

[7] D. Vela, "Planning and creating the curriculum for pre-kindergarten students," HAAEYC Fall Conference. Global Early Childhood Development Center, 2012.

[8] M. Hunter, "Mastery teaching," El Segundo, California, Tip Publication. 68-69, 1985.

[9] M. D. Steward, G. S. Martin, A. C. Burns, and R. F. Bush, "Journal of marketing education," SAGE Publications. DOI: 10.1177/0273475309360152, 2010

[10] C. A. Berg, and M. Clough, "Hunter lesson design: the wrong one for science teaching," Education Leadership, 1991.

[11] L. B. Hansen, M. McCollum, S. M. Paulsen, T. Cyr, C. L. Jarvis, G. Tate, and R. J. Altiere, "Evaluation of an evidence-based peer teaching assessment program," American Journal of Pharmaceutical Education. 71 (3) Article 45, 2007.

[12] M. C. Mitchelmore, and P. White. "Development of angle concepts by progressive abstraction and generalisation," Educational Studies in Mathematics, 41(3), 209, 2000.

[13] M. C. Mitchelmore, and P. White, "Teaching mathematical concepts: instruction for abstraction," Invited regular lecture presented at the 10th International Congress on Mathematical Education, Copenhagen, Denmark, 2004.

[14] H. M. Park, "Univariate analysis and normality test using SAS, Stata, and SPSS," Working Paper. The University Information Technology Services (UITS) Center for Statistical and Mathematical Computing, Indiana University, 2008.

[15] S. O'Neil, "Basic statistic for the utterly confused," University of Pretoria, Faculty of Economic and Management Science, 2009.

[16] D. W. Nordstokke, and B.D. Zumbo, "A cautionary tale about levene's tests for equality of variances," Journal of Educational Research and Policy Studies, 7(1), 1-14, 2007.

[17] D. W. Nordstokke, and B. D. Zumbo, "A new non-parametric test for equal variances," Psicologica, 31, 401-430, 2010.