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CONCEPT MAPPING: DOES IT IMPROVE ACADEMIC ACHIEVEMENTAMONG NURSING STUDENTS

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ABSTRACT

Introduction: The effectiveness of teaching and learning process is highly dependent on the methods and strategies of teaching and learning practices. As a result, nurse educator must choose and use the suitable method to help the nursing students to achieve the learning objective.

Methodology: There were 218 respondents. This study consisted of two-group quasi experimental study with pre- and post-test design. The experimental and control groups received education using concept mapping and lecture method respectively. The data was analyzed using inferential and descriptive statistic.

Results: In the pre-test, students were taught using concept mapping. These students had achievement mean scores of 11.23, SD=2.59 and post–test was 13.19, SD=1.71 with mean gain scores of 1.96. Students who were taught using lecture method had an achievement mean scores of 10.71, SD=2.23 in the pre-test and post-test was 12.60, SD=1.64 with mean gain scores of 1.89. The results showed an increase in grade achievement, the percentage pass for the experimental group increased from 95.4% in pre-test to 100% in the post-test. The percentage pass for control group had increased from 93.57% in pre-test increased to 99.08% in the post-test.

Conclusion: Student-centered learning is a teaching method that is active and can change passive to active learning. Findings from several reviewed studies suggest that using concept mapping can improve academic performance in nursing education and is a valuable teaching strategy.

Keywords: Concept mapping, Nursing students', Grade achievement, Academic Achievement

INTRODUCTION

Teaching strategy involves the selection and planning of the teacher in determining teaching approaches, methods, techniques and activities to achieve the objective of learning. The effectiveness of teaching and learning process is highly dependent on the methods and strategies of teaching and learning practices. Due to this, nurse educator must choose and use the suitable method to help the nursing students to achieve their learning objective. Concept mapping is an innovative teaching method and can be reflected into meaningful learning. Likewise meaningful learning cannot be separated from critical thinking. However, in Malaysian nursing education this is not being practiced widely among the nurse educators and the student. It is because in Malaysian nursing field, there is not much research with regards to concept mapping in the Malaysian nursing context. Therefore, in the present study the researcher wants to evaluate the impact of concept mapping on academic performance among nursing students.

According to Bloom's Taxonomy (1956), the higher level of cognitive thinking takes place as the student begins to analyze, synthesize and evaluate. Findings of this research will be applied in multiple disciplines and people from other disciplines can get benefit from this research by using concept mapping in other subject areas to improve academic performance. This study is expected to be helpful for students to shift the learning pattern from rote learning to meaningful learning of concepts as this kind of learning actively involves students in the education process through individual and

group work in structured tasks. This study will introduce the concept mapping to the curriculum developers to be used as an effective learning strategies for promotion of meaningful learning in nursing education.

Objective

To compare the mean scores of students grade achievement pre and post-test between experimental and control groups.

Literature Review

Concept mapping as an assessment tool has two components: a task that students perform to demonstrate and record their knowledge and a scoring system which a researcher or teacher uses to evaluate the students' knowledge (Stoddart *et al*., 2000). Concept mapping can be used to assess the higher order learning objectives which are not possible to measure by objective type questions (Novak & Gowin, 1984). It can be a good alternative for the traditional test items such as multiple choice questions (MCQ) (Jong *et al.*, 2004). The study found that concept mapping has a good potential to be used as a diagnostic tool to find out alternate concepts or misconceptions of students.

Concept mapping strategies may be useful for analysis of individual student's thinking processes in the nursing course. The use of concept maps was shown as a Metacognitive tool to enhance academic performance by enabling students to synthesize and retain complex information, thus promoting meaningful learning (Taylor & Wros, 2007; August- Brady, 2005). In the view of Safdar (2010), if teachers learn how to construct concept maps and use them for planning and assessing lessons, they will be able to teach students better the concept of making maps to help them to organize their thoughts and ideas. That means nurse educator should have knowledge and skills regarding the development of concept maps in preparing lesson plan for their teaching methodology. Hence, they will be able to teach student better how to construct concept maps.

In addition,concept maps are suitable to all types of learning styles and is the effective method to convey large amounts of information in a limited time (Burgess & Yaoyuneyong, 2010). Consequently, concept mapping is one method of teaching strategies that require students to become involved actively in their learning and should be incorporated into all nursing courses. The use of concept mapping as a teaching method increased the student's achievement (Ponusamy, 2005). This kind of wisdom and strategy of the teacher in choosing the appropriate approach along with efficient planning methods and technique of learning will provide better impact on the understanding of the students regarding the learning process.

In fact, concept mapping also helps students to build and explain the logically connected basics idea to the content domain, before progressing to a higher level in the areas of content, can improve the quality of gained knowledge and sustained in the long term memory. This opinion is in line with the views of Rashid (2000) on the use of concept mapping can facilitate thinking and help students to strengthen memory and students are able to remember important facts which can be a good elaborate.

RESEARCH METHODOLOGY

This study was a two group quasi experimental study with pre and post-test design. Multi stage sampling design was used to select a representative sample for the studies. Four nursing colleges were selected as the population of the study based on zones. East zone includes Kolej Kejururawatan Kubang Kerian (KKKK), Kelantan, Northern zone Kolej Kejururawatan Pulau Pinang (KKPP), Penang, Central zone Kolej Sains Kesihatan Bersekutu (KSKB) Sungai Buluhand Southern zone Kolej Kejururawatan Melaka (KJM). Based on the random sample, the selected students were assigned as control (KSKB) Sungai Buluh and Kolej Kejururawatan Melaka) and experimental group (KKKK and KKPP). Permission from all directors of Nursing from four nursing colleges was obtained.

The total number of population of 254 students was selected from four colleges. By using sample size from Krejcie & Morgan (1970) with a confidence level of 95%, the sample size requires would be 218 respondents. The respondents were divided into two groups using random sampling sample. One of the groups considered as the experimental group (concept mapping) with 109 students and control group (lecture method) with 109 students. The MCQ test has 20 question based on Diabetes Mellitus topic and four option multiple choices. It was used as pre and post- test.

Data collection

All the participants were informed about the purpose of the study and the confidentiality of the data were obtained. Those meeting of the inclusion criteria were approached individually. All the participants were given an explanation of the rationale for the research and the process by which confidentiality was maintained. Before giving consent, participants were given a short briefing on how the questionnaire was supposed to be answered. During the first week, the questionnaire for pre-test were distributed among the respondents, 35 minutes were allotted to fill up the form, data were collected by the researcher on the same day after the explanation of study and the consent were obtained.

All participants attended the same hours of theory lecture. For the post-test, the same questionnaires were given on the second week of the medical-surgical course and 20 minutes duration was allotted to the experimental and control group. Statistical Package for the Social Science for Windows (SPSS) version 23 software was used to analyze the collected data. Paired *t*-test was performed to compare the mean difference between pre and post-test scores among experiment and control groups.

Study ethics

Before carrying out this research project, an approval letter was being sent to Bahagian Pengurusan Latihan (BPL) and four Directors of the Nursing Colleges ILKKM for consent.The researcher explained the aim and procedure of the study to the respondents. The researcher also explained the respondents regarding the confidentiality of the data and they were only used for the purpose of academic research. The written and informed consent of all participants was acquired.

RESULTS

Table 1 shows the grade of the students' achievement based on Institusi Latihankementerian Kesihatan Malaysia (ILKKM) for the allied health students. The passing mark was 40 % above. The result was based on the 20 multiple choice questions (MCQ).

Table 1: Grade student achievement based on ILKKM

Score MCQ(20)	Mark (%)	Grade
20	100	A
19	95	
18	90	
17	85	
16	80	
15	75	A-
14	70	B+
13	65	B
12	60	B-
11	55	C+
10	50	C
9	45	C-
8	40	D+
7	35	D
6	30	E
5	25	
4	20	
3	15	
2	10	
1	5	

Descriptive Statistic on the Academic Performance of the Nursing Students

Table 2 shows the pre and post-test achievement mean and standard deviation score of student in MCQ due to the teaching strategy. It shows the effect of teaching strategies concept mapping and lecture on student achievement mean scores in medical subject of Diabetic Mellitus. On pre-test, the students were taught to use concept mapping. The achievement mean score of these students were 11.23 and a standard deviation of 2.59 while at post test, the achievement mean score was 13.19, standard deviation 1.71 and a mean gain score of 1.96. On the other hand, students who were taught using lecture method had an achievement mean score of 10.71 and standard deviation of 2.23 in the pre-test and post -test achievement with the mean score of

12.60, a standard deviation of 1.64 with mean gain score of 1.89. This implies that the experimental group appears to have performed better than the control group in the achievement test.

Table 2: Pre and post test achievement mean and standard deviation score of student in MCQ due to teaching strategy

Teaching strategy	N	Pre-test		Post-test		Mean gain
		Mean	SD	Mean	SD	
Concept Mapping (Experimental group)	109	11.23	2.59	13.19	1.71	1.96
Lecture (Control group)	109	10.71	2.23	12.60	1.64	1.89

Inferential Statistic on Academic Performance Nursing Students

Result in table 3 shows no significant difference observed between the pre-test on academic achievement among experimental and control groups (t=1.67, p>0.05). It is implying that the students of both groups have same level of achievement in pre-test academic with regard to Diabetic Mellitus subject courses.

Table 3: Comparison of pre-test on academic achievement among experimental and control groups (n=218)(n=218)

Test	Group	N	Mean	SD	*df*	*t*-value	*p*-value
Pre -test	Experimental	109	11.23	2.59	108	1.67	0.098
	Control	109	10.71	2.23			

**p<0.05 significant*

Table 4 reveals that the post–test mean scores for the experimental group were 13.19, while the control group was 12.60. A confidence level of 95% was selected. The finding shows a significant difference between the scores of the post-test (t=2.53, p<0.05) between experimental and control groups. In other words, the experimental group performed better than control group. There is strong evidence that the teaching using concept mapping improves the scores marks.

Table 4: Comparison of post-test on academic achievement among experimental and control groups (n=218)

Test	Group	N	Mean	SD	*df*	*t*-value	*p*-value
Post-test	Experimental	109	13.19	1.71	108	2.53	0.013*
	Control	109	12.60	1.64			

**p<0.05 significant*

Grade of the Students' Achievement Among the Both Groups

It can be formulated that the overall achievement of the students has increased. However, the achievement of the experimental group was higher compared with the control group. Passing mark for both tests group was 40% and above. The results shows an increase in post-test, the percentage pass for the experimental group increased from 95.4% in pre-test to 100% in the post-test. While the percentage pass for control group had increased from 93.57% in pre-test increased to 99.08% in the post-test. These findings clearly demonstrated that teaching and learning using concept mapping leads to the improvement of performance compared to the control group using the lecture method.

In terms of the quality and the grade of the students' achievement, it was found that in the experimental group the number of students in grades A, B was increased and decreased in grade C in the post-test compared to the control group. The result showed that in the pre-test the number of students with grade A (80-100%) was 6(5.5%) in the experimental group and nobody got grade A in control group. However, after implementation concept mapping the experimental group students got grade A was 10(9.1%) and only one students in control group got grade A in the post-test.

The number of students with grade B (65-69%) was 19(17.4%) in experimental group and 14(12.8%) in control group. However, in the post-test, in the experimental group more students got grade B, 33(30.3%), while the control group 26(23.9%) got grade B in the post-test. The number of students with Grade C decreased, as most of the students have experienced an increase in their grading scale (mostly with grade A and B).

In the experiment there was a decrease in grade C with 12(11.0%) in pre-test to 5(4.6%) in post-test. While in the control group, this change was very significant from student who obtained grade C were 20 (18.3%) in the pre-test and decreased to 6(5.5%) in the post-test. The data analysis also shows experimental group passed 100% in the post-test, while in the control group there was only one student who failed in the post-test. Overall, the students who were using concept mapping methods contribute positively in the student achievement in testing multiple choice questions (MCQ) (Table 5).

Table 5: Comparison of the grades pre-test and post-test Experimental group (n=109) and Control group (n=109)

Grade(marks)	Pre-test (%) Experimental	Post-test (%) Experimental	Pre-test (%) Control	Post-test (%) Control
A(80-100)	6(5.5)	10(9.1)	-	1(0.9)
A-(75-79)	4(3.7)	11(10.1)	5(4.6)	7(6.4)
B+(70-74)	7(6.4)	24(22.0)	9(8.3)	30(27.5)
B(65-69)	19(17.4)	33(30.3)	14(12.8)	26(23.9)
B-(60-64)	19(17.4)	14(12.8)	13(11.9)	18(16.5)
C+(55-59)	14(12.8)	10(9.2)	11(10.1)	17(15.6)
C(50-54)	12(11.0)	5(4.6)	20(18.3)	6(5.5)
C-(45-49)	9(8.3)	1(0.9)	22(20.2)	1(0.9)
D(40-44)	14(12.8)	1(0.9)	8(7.3)	2(1.8)
E(<40)	5(4.6)	-	7(6.5)	1(0.9)
Total	100	100	100	100

Figure 1 shows the frequency and distribution of grades among both groups. 9 out of 218 (4.13%) students in the both groups have grade A(3.67) (4.1%), 79 out of 218(36.23 %) got grade B+ (3.33) (36.2%). Most of the respondents got grade B (3.00) was 101 (46.3%) and 29 out of 218 (13.30%) got grade B(2.67) (13.3%).

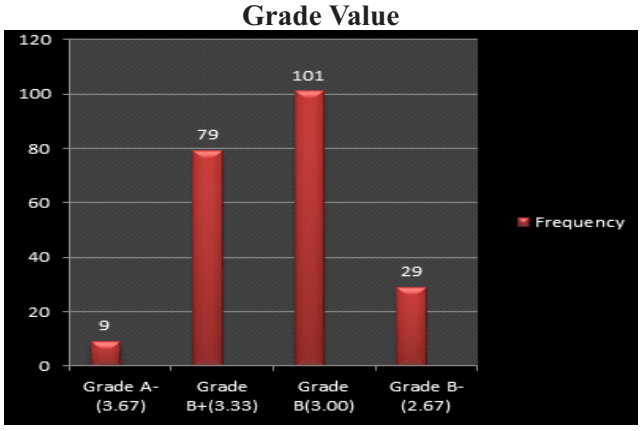

Figure 1: Frequency and distribution of grades among both groups.

DISCUSSION

Comparing pre-test scores among both groups

There was a significant difference in the achievement mean score of students who were taught using concept mapping and those taught with lecture method as the mean score of the experimental group (13.19) is more than the mean score of the control group (12.60). To compare and verify if the pretest scores of the experimental group and control group were statistically the same, a paired *t*-test was run. The results indicate that there is no significant difference between experimental group and control group (t=1.67, p=0.098). This establishes that all respondents have the same prior knowledge of the achievement level. The students of both groups have the same level of knowledge and learning abilities.

Comparing post-test scores:

In the comparison of post-test mean score among both groups the result shows that there is a significant difference between the scores of the post-test (t=2.53, p=0.013) and the experimental and control groups. It can be conclude that use of the concept mapping technique is beneficial and leads to a significant increase in the mean of the student achievement test. Similar results are also reported by Zahara & Nurliah (2009) in their study on the use of concept maps in improving achievement in the subject of history. The finding of this study found that there was a significant difference in means achievement of the pre and post-test. The mean for the pre-test was 39.7, SD=11.02; meanwhile the mean for the post-test was 52.7, SD=11.10, the mean differences between pre and post-test was 13.0.

This result is also consistent with some findings of earlier investigator (Mat Jamudin, 2002; Vilberg, 1996; Cliburn, 1990). These studies revealed that there is a significant difference in student achievement in pre and post-test. It indicates the effectiveness of concept mapping in improving student achievement. The mean achievement in post-test is greater than mean pre-test and the use of concept mapping is effective in increasing academic achievement among the students.

Chabeli (2010) recommended that nurse educator must use concept mapping in teaching method because concept mapping can facilitate the critical thinking and deep learning approach. Concept mapping also play pivotal role in enhancing student centered learning. Similar finding by Parsa & Nikbakth (2004) stated that concept mapping is better than lecture method in producing meaningful learning. Concept maps is a powerful teaching and learning technique for nursing education that facilitates meaningful learning (Pilcher, 2011).

However, the result of this study is not in agreement with the findings of Sarhangi *et al.*, (2010). They reported that there was no significant difference between experimental and control group in comparing

concept mapping and lecture method. Similar study finding found that concept mapping does not improve critical thinking skills and dispositions (Zepura, 2006).

Comparison of Grades in the Student Achievement Between the Experimental and Control Groups

The use of concept mapping in teaching and learning have a positive impact in improving student achievement. Descriptive analysis of the pre and post-test showed a significant increase in post-test achievement. It was found that the percentage of students who passed in the experimental group increased from 95.4% in pre-test to 100% in the post-test. Meanwhile the percentage of students who passed in the control group increased from 93.57% in pre-test to 99.08% in the post-test. In other words, the use of concept maps has increased the level of students passing rates to 100 %.

In terms of quality grade student achievement it was found that the number of students in grades A, B increased and there was a decrease in grade C in the post-test in the experimental group compared to the control group. This suggested that the use of concept mapping teaching method improved academic achievement of the experimental group. Researcher emphasized that the Rusnani Concept Mapping (RCM) can be used as teaching and learning strategies in class. The use of concept maps can be of interest to students to improve their understanding, especially students with low achievement.

Concept mapping is an innovative teaching strategy to enhance academic achievement, improve students' academic achievement, increase information recall and retention and reduce cognitive overload (Gobert & Clement, 1999; Lee & Nelson, 2005). This is supported by study done by Ismail & Hassan (2004) and Ahmad (2005) which stated that the use of concept mapping improved student achievement in a subject. Studies have shown that concept mapping helps the university students to learn courses content better and improve exam scores (Francisco *et al.*, 2002; Taagepere & Nooru, 2000).

In another study done by Esiobu & Soyibo (1995) in a secondary school, in the subject, Biology, in Nigeria of showed that the students taught through concept mapping demonstrated significant improvement (effect size 2.0) than the students taught through traditional method. Another study by Maneval *et al*., (2011) was done to determine whether concept mapping is a method for teaching critical thinking skills more effectively than traditional nursing care plans with nursing students. There were no statistically significant differences among the control group and the experimental group on demographic information. However, the experimental group using concept mapping had a significantly higher grade point average (3.28) on admission to the school than the control group (3.11, p=0.037). This finding indicated that using concept mapping enhanced the academic achievement of the students.

CONCLUSION

Students should take responsibility for their own learning. But it is the role of an educator to choose best teaching method to make the learning meaningful and effective toward the student's cognitive structure that will help them to understand about the topic that are taught. Therefore, student-centered learning is a teaching method that is active. The use of concept mapping can change passive learning to active learning. Findings from several reviewed studies suggest that the use of concept mapping can improve academic performance in nursing education and is a valuable teaching strategy. But significantly more research is needed in order to conclude that concept mapping should be embraced by nurse educators.

However, in Malaysian nursing education this method of teaching is not practiced widely among the nurse educators and the students, though there are adequate evidences on the use of concept mapping. In an effort to prepare nursing students to deliver safe quality care, critical thinking become essential to nursing education. If nurse educators do not begin using some alternative, more interactive classroom activities, students' opportunities to think critically will be limited. Therefore, the nurse educator must understand how students can learn and they must formulate acceptable method that can be applied to teach them. Concept mapping is one of the methods of teaching and learning that promote critical thinking because it can trigger their cognitive processes.

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