The Effect of Concept Mapping on Students' Learning Achievements and Interests in Taif University

Hanan .A. M. Youssef[1] and Magda. A.M. Mansour[2]

[1]Head of Nursing Department, Assistant Professor of Critical Care Nursing, Taif University
[2] Associate Professor of Adult Nursing –Assiut University, Taif University
drhanan.y@tu.edu.sa Magda_albeah@hotmail.com

Abstract: There is a growing awareness of the need for changes in nursing education systems, especially in developing self-learning techniques where the student is an active participant in the learning process. Nursing students are exposed to a vast amount of information and reading material that is very specific, technical, and new to the students, they need to able to link learned facts, concepts and principles with new knowledge in order to make sound rational decisions in practice. Concept mapping, a learning strategy used to understand key concepts and relationships between concepts, has been suggested as a method to plan and evaluate nursing care. **The purposes for this study were to (1)** Find out whether concept mapping improved students' learning achievement in an advanced nursing courses within the nursing baccalaureate program; and Identify students' attitudes towards using concept mapping as a learning tool. **Method(s):** One-group pretest-posttest quasi-experimental design used with senior-level baccalaureate students ($n = 46$) students from two classes enrolled in an advanced nursing course at taif - university in saudi Araba. Students completed questionnaires to self-evaluate their learning and report their satisfaction with concept mapping. Tools were constructed to collect the data, demographic questionnaire, End-of-Training-Concept of Mapping Usage Questionnaire, and End of Semester Concept Map Usage Questionnaire. **Results:** The experimental data revealed two important results. First, adopting a concept mapping strategy can significantly improve students' learning achievement compared to using a traditional teaching method. Second, most of the students were satisfied with using concept mapping in advanced nursing courses. **Conclusions & Recommendations:** This study supported concept mapping as an additional learning strategy and has extended knowledge in the nursing education and also enhance student interests in learning nursing. Student also thought that concept mapping could be usefully used in other curriculum areas. Further study is recommended to study the relationship between learning style preference and concept mapping as a teaching strategy.
[Hanan .A. M. Youssef and Magda. A.M. Mansour. **The Effect of Concept Mapping on Students' Learning Achievements and Interests in Taif University.** *Life Sci J* 2012;9(2s):346-353]. (ISSN: 1097-8135). http://www.lifesciencesite.com. 39

Key words: Concept Mapping; Interactive Learning Strategy; Baccalaureate Nursing Education

1.Introduction:

In science education in recent years, the increasing awareness of the importance of learner-centeredness in the teaching–learning situation has generated a lot of attention in relation to understanding how learners learn and how to help them learn about concepts (Jegede, Alaiymola, & Okebukola, 1990, Novak, 2002, & Kinchin, 2003).

Nursing students are exposed to a vast amount of information and reading material that is very specific, technical, and new to the students. Unless nurse educators provide a learning environment that promotes understanding through interaction, students might only commit unassimilated information to their short-term memory through rote learning, and no meaningful learning will occur. Nursing students must be able to link learned facts, concepts and principles with new knowledge in order to make sound rational decisions in nursing practice. These efforts in assisting nursing students to learn more effectively have led to the development of meta-cognitive strategies to enhance meaningful learning

(Biggs, 1988, , Cliburn, 1990, Meyer & Shanahan, 2004 & Kinchin, De-Leij & Hay, 2005).

Mapping is defined as a graphic or pictorial tool used to arrange key concepts. In nursing education, the key concepts are assessment data that students collect either through case studies or clinical assignments. The map develops as students diagram schematically the relationships among various clinical data. This process assists the students to visualize complex relationships and to apply theory to the clinical area (Yaowalak, 2005 & Novak & Canas 2008).

Concept maps (or "Cmaps") are visual depictions of concepts and their relationships and have been consistently heralded as an effective educational tool for nearly 40 years. They consist of concepts, visually represented as terms bound in a circle or square, which are linked to other concepts with lines called crosslinks. These lines are accompanied by a verb or symbol, such as "+" or "-", which describe the relationship between the two concepts and may include an arrow indicating the

relationship's directionality. Concept maps are typically arranged hierarchically, with the main concepts placed at the top of the map and the sub-topics arranged lower down. Successful concept maps usually have a critical question that the map seeks to address (Novak & Canas, 2006, & Hinck et al., 2006).

Novak (1990) outlined the potential uses of concept mapping for the improvement of learning and teaching in science classrooms from this we may organize the potential of concept mapping to improve science education into four categories: (a) as a learning strategy, (b) as an instructional strategy, (c) as a strategy for planning curriculum, and (d) as a means of assessing students' understanding of science concepts. These mapping tools take a variety of names including: ''concept mapping'', ''mind mapping'' or ''argument mapping''. The potential of these tools for educational purposes is only now starting to be realized.

Maps allow the separate encoding of information in memory in visual and well as propositional form, a phenomenon called ''conjoint retention'' or ''dual coding'' (Jacobs *et al*., 2002, & Novak & Canas, 2006).

In simple terms, processing information verbally as well as pictorially helps learning by virtue of using more than one modality. On the other hand in the clinical nursing practice concept maps enabled a holistic view of the patient and covered all patient problems and students learned to integrate and understand relationships between patient problems and quality of care needed. Both faculty and students found concept maps an effective strategy in developing critical thinking skills. (Preszler, 2004, &Yaowalak, 2005).

The study aims to:

(1) Find out whether concept mapping improved students' learning achievement in an advanced nursing courses within the nursing baccalaureate program; and

(2) Identify students' attitudes towards using concept mapping as a learning tool.

2. Subjects and Methods

Research design:

A quasi-experimental pre- and posttest design was used to examine the The effect of using CMs on improving the studnts acheivements in selected nursing courses and to describe their attitude toward this new adopted teaching method .

Setting :

The study was conducted in Nursing Department- College of Applied Medical Sciences – Taif University.

Subjects:

All Senior-level baccalaureate nursing students (n = 46) enrolled in the 3rd and 4th years who had educated traditional in the prior basic adult nursing course in the second year were included. The participants in this study were 46 students from two classes in advanced &critical accounting courses at the taif –university enrolled in the 2nd semester of 2012. One class of 15 students was randomly assigned & the other class of 31 students. This group utilized concept maps in teaching and learning, None of the students reported previous experience in concept mapping.

Tools of data collection:

Tools were constructed to collect the data, demographic questionnaire, End-of-Training-Concept of Mapping Usage Questionnaire, End of Semester Concept Map Usage Questionnaire and Concept map rubric System & Academic Performance Achievement**.

Tool I: Demographics questionnaire.

Each class had the first two weeks of the semester to complete a demographics questionnaire. This measure asked the participants to record their age, academic standing, and their number of completed college units.

Participating student age ranged between 21 and 23 years old with mean (SD) 22.04 (.697) years, and all of them had 6th & 8th level in nursing department & Saudi student female & None of the students reported previous experience in concept mapping& most of student using net map 54.3%,chain map 37% respectively .

Tool II: End-of-Training-Concept of Mapping Usage Questionnaire

This tool is adopted from Patrick Francis Cravalho master thesis 2010, it is an inventory of concept map used over the first half of this semester. An official permission from the corresponding author to use the scale was received via Email. There are no right or wrong responses, only different ones and indicate whether or not the student agree with the mentioned statements by choosing the appropriate response. The last two questions are multiple-choice and not based on an agreement scale. The students must be responding to all of the items. honestly. End of training questionnaire summary. In total, 46 participants form the concept map group completed the end of training concept map usage questionnaire. Of the 14 questions on this inventory, 12 were answered using a 5-point Likert-type agreement scale anchored with a 1 (Strongly Disagree) and a 5 (Strongly Agree). The Cronbach Alpha coefficient of the instrument was 0.85 for the

study sample. The instrument had high construct validity (with a part–whole correlation of 0.91) (Kerlinger, 1986).

Tool III: End of semester questionnaire summary:

In total, 46 participants form the concept map group completed the end of semester concept map usage questionnaire. Of the 11 questions on this inventory, 7 were answered using a 5-point Likert-type agreement scale anchored with a 1 (Strongly Disagree) and a 5 (Strongly Agree). The Cronbach Alpha coefficient of the instrument was 0.85 for the study sample. The instrument had high construct validity (with a part–whole correlation of 0.91) (Kerlinger, 1986).

Tool VI: Concept map rubric and quantitative analysis:

The experimenter created a qualitative scoring rubric to be used in conjunction with a quantitative analysis of concept map structure. The rubric was developed through examining other concept map rubrics and making an outline of the major points should be included in the concept mapping represent each topic in the courses. This rubric was separated into four sections of evaluation: Content Organization, Structure, Communication, and Overall Presentation. For the Content Organization section, each map was assessed on overall organization, format, and appropriateness of main topic and sub-topics. For the Structure section, each map was assessed on the clearness of nodes and links. For the Communication section, each map was assessed on the overall effectiveness of the map structure in communicating the inherent relationships between the main topic and subtopics. For the following topics the given assignments were: **371360-8 Advanced Adult Care Nursing, and 371481-5 Critical Care Nursing:**

▪ Bedside Hemodynamic Monitoring Cardiac Arrhythmias
▪ Acute Coronary syndrome
▪ Heart failure
▪ Cardiomyopathy Acute respiratory failure
▪ Acute lung injury(Acute respiratory distress syndrome {ARDS})
▪ Acute pancreatitis
▪ Specific trauma injuries
▪ Renal stone &hemodialysis

Tool V: Academic Performance:

The academic performance of all participants was measured two times over the course of the semester, with an exam at the mid and end of semester. The Mid- term was pretest and Final exam was posttest consists of the multiple-choice questions were written to assess the students' conceptual and/or applied knowledge of the concepts covered in both advanced and critical care nursing courses. A small number of simple recall-type questions (in the form of short-essay and matching questions were added. These questions were created by the instructor and were drawn from both the textbook and class lectures. A single exam score, out of 40 for mid-term exam and 40 for critical and advanced respectively, was calculated for all participants by summing the correct responses to each question making up an exam, with a separate score being calculated at each of the times of measurement.

Method:
1. Permission to conduct the study was taken from the research committee in College of Applied Medical Sciences – Taif University after explanation of the aim of the study.
2. Informed consent to participate in the study was obtained from the students after clarification of the aim of the study.
3. Pilot was carried out after adopting the tools to exam the content validity, clarity and reliability. The subjects of the pilot study were included in the main study sample because no modifications were done to the tool.
4. **First**, before the starting of the explanation of the course's content, the researchers discuss the overall experimental processes and explained what and why concept mapping is a useful tool for learning and how concept mapping can be used to show relationships among concepts, and then spent two weeks training students to draw concept maps on nursing process as a framework will be used in caring for patients populations included in courses' contents. The researchers then taught from the Evolve Elsevier site the concept maps creator© as the instructional medium. After finishing this training period, distribution of **End-of-Training-Concept of Mapping Usage Questionnaire** was done, then starting the course materials and chapters explanations, the students were asked to use concept maps to represent what they had learned from the chapter. The researcher then corrected student-constructed concept maps according to rubric system. The misconceptions were corrected directly following each chapter and before starting next one.
5. **Second**, **End of semester questionnaire summary** was used to investigate the students' attitude towards their learning experiences. The Mid-term and final exams were introduced to the students to evaluate their achievements.

Statistical Analysis:

Data entry and statistical analysis were done using SPSS14.0 statistical software packages. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations and medians for quantitative variables. Pearson correlation analysis was used for assessment of the inter-relationships among quantitative variables. Statistical significance was considered at p-value <0.05.

3.Results

Table (1) & figuer (1) End of training concept of mapping questionnaire:

In total, 46 participants form the concept map group completed the end of training concept map usage questionnaire. Of the 14 questions on this inventory, 12 were answered using a 5-point Likart-type agreement scale anchored with a 1 (*Strongly Disagree*) and a 5 (*Strongly Agree*). The descriptive statistics for the group responses to these statements are presented in this table. This table show majority of student accept & understand concept of mapping with mean & SD (45.82 ± 10.274) .Of the remaining questions on this survey, one asked which map the participant preferred to use and one asked if the participant had prior experience using concept maps in a class. Of the three types of maps taught to the class, most students preferred using a net map (54.3%, $n = 25$), followed closely by a chain map (37%, $n = 17$), and coming next was a spoke map (8.7%, $n = 4$). Of the respondents in the concept map class, the majority had no prior experience with concept maps in high school or college (100% =46) . this table show that majority of student satisfied (95.7% n=44) from end of training concept of mapping.

Table 2 End of semester concept of mapping questionnaire

46 participants form the concept map group completed the end of semester concept map usage questionnaire. Of the 11 questions on this inventory, 7 were answered using a 5-point Likert-type agreement scale anchored with a 1 (*Strongly Disagree*) and a 5 (*Strongly Agree*). The descriptive statistics for the group responses to these statements are presented in this table. This table show majority of student (28.456, ± 5.886), agreement concept of

mapping useful for improving academic performance, increased understanding theoretical course, & for learning the material covered courses. Of the remaining questions on this survey, the participants were again asked which map they preferred to use and if they had prior experience using concept maps. For this inventory, most students noted that they preferred using a net map (54.3%, $n = 25$), followed by a chain map (37%, n=17) , coming next was a spoke map (8.7%, n=4), and finally the entire sample reported having no preference. The last two questions on this inventory were dichotomous items requiring a yes or no answer to indicate if a participant included concept maps in their courses notes and if a participant used concept maps outside of class to study advanced & critical .The majority of the respondents reported that they did use concept maps in their courses notes (56.5%, $n = 26$), and the remaining students indicated that they did not include concept maps in their courses notes (43.5%, $n = 20$). The majority of the respondents also reported that they did use concept maps to study courses (63%, $n = 29$), and the remaining students indicated that they did not use concept maps to study courses (37%, $n = 17$), most of student satisfied (95.7% n=44) from end of semester concept of mapping. **(figuer 2)**this table show that majority of student satisfied (95.7% n=44) from End of semester concept of mapping questionnaire**.**
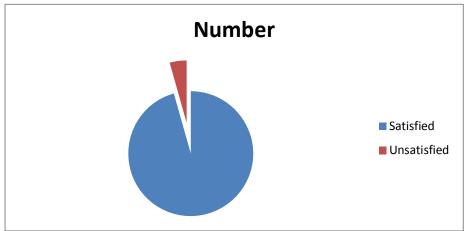
Table 3 concept of mapping rubric assessment:

This table explain concept of mapping regard rubric assessment for students assignment, all students take 100% regard content of organization this include well organized, logic format, main topic clear & content appropriate sub-topic\concept. Regarding structure (nods demonstrate conceptual understanding, links are labeled or precisely) .most of student (63%n=29) exemplary & (37%n=17) Exceed standard, as regard communication, majority of student, (47.8%n22 , 39.1%n=18, &13&n=6) respectively, exceeds standard, exemplary & adequately meet standard., finally, overall presentation, most of student (60>9% n=28,19.1% n=9&19.1%n=6) respectively exceeds standard ,exemplary & adequately meet standard.

Table (4),This Table Show high significance difference regared acadmic performance among students (before & after applying concept of mapping) in mid-term & final exam.

Table 1: End-of-Training-Concept of Mapping Questionnaire Descriptive Statistical Analysis (n=46)
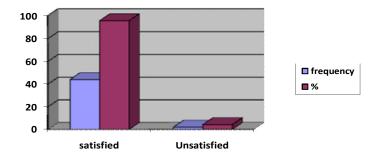
Statements	M	±SD
1. I understand what a concept map is.	4.06	.92
2. I understand the three types of concept maps discussed in class	3.76	1.196
3. I understand when to use each type of concept map discussed in class.	3.67	1.16
4. The concept map homework assignments are useful for learning the material covered in my course.	4.04	.94
5. The concept map homework assignments have been stressful for me.	3.84	1.154
6. The concept map in-class lessons are useful for learning the material covered in my course.	4.021	1.085
7. The concept map in-class activities are useful for learning the material covered in my course.	4.08	.914
8.The "Concept Map Review" document was useful for clarifying the question(s) I had about concept mapping	3.97	1.125
9. I include concept maps in the notes I take for my course.	3.91	1.071
10. I use concept maps, outside of class, to study the material covered in my current course.	3.54	1.109
11. I plan on using concept-mapping techniques to study my course over the rest of the semester.	3.50	1.110
12.I plan on using concept-mapping techniques to study for my other courses over the rest of the semester.	3.39	1.219
Total means	45.82	10.27

Figures 1 Descriptive Statistics for Agreement Scale Statements from the End of Training Concept Map Usage (Satisfy or Unisatisfy)

Table 2 : End of Semester Concept Map Usage Questionnaire Descriptive Statistics (n=46) Analysis (n=46)

Statement	M	±SD
1. The concept map homework assignments were useful for learning the material covered in this course.	4.043	.965
2. The concept map homework assignments were stressful for me.	3.73	1.042
3. I plan on using concept-mapping techniques to study for any future course that I may take	4.108	.948
4.I plan on using concept-mapping techniques to study for other future courses, besides this courses, that I may take.	4.021	1.043
4. I feel that using concept-mapping strategies was useful For increasing my theoretical understanding of course.	4.260	.905
5. I feel that using concept-mapping strategies was useful for improving my academic performance in this course.	4.282	.910
6. I feel that using concept-mapping strategies was useful for decreasing my anxiety towards course	4.000	1.154
Total	28.456	5.886

Figuer 2 -Descriptive statistic for agreement scale statement from the end of semester concept of mapping (satisfied or unsatisfied)

Table 3: Application of Rubric System As Evaluation Tool For Concept Map Based Assignment

Variable	N	%	M	±SD
Content organization 1.Adequately Meet Standard 2.Exceeds Standard 3.Exemplary	 46	 %100	 3.000	 .0000
Structure 1.Adequately Meet Standard 2.Exceeds Standard 3.Exemplary	 17 29	 37% 63%	 2.630	 .488
Communication 1.Adequately Meet Standard 2.Exceeds Standard 3.Exemplary	 6 22 18	 13% 47.8% 39.1%	 2.260	 .681
Overall presentation 1.Adequately Meet Standard 2.Exceeds Standard 3.Exemplary	 9 28 9	 19.6 60.9 19.6	 2.000	 .632

Table 4. Comparison of Mean Scores for Academic Achievmnet (Between Mid-Term & Final Exam) Among Student Before & After Applying Concept of Mapping

Variable	Paired- t-test				
	Final –exam			Df	t. test
Mid term exam	Means	±SD	T	45	.000**
	4.529	3.9412	7.79		

(*) Statistically significant at p<0.05 (**) Statistically significant at p<0.01

4. Discussion

The study aimed to (1) Find out whether concept mapping improved students' learning achievement in advanced nursing courses within the nursing baccalaureate program; and (2) Identify students' attitudes towards using concept mapping as a learning tool. The results showed that students in the concept mapping class improved in their learning achievement more than did students in the traditional expository teaching class. From the present investigation, it was found that concept mapping is a good education innovation for assisting nursing students to summarize their own concepts and improve their knowledge among nursing courses of 3rd and 4th years at the end of training concept mapping training sessions and that was reflected in **table (1)** and congruence with (Ahlberg *et al.,* 2005, MacNeil, 2007, and Chei-Chang, 2008) who said that adopting a concept mapping strategy can significantly improve students' learning achievement compared to using a traditional expository teaching method and most of the students were satisfied with using concept mapping in an advanced accounting course.. It can be seen that the nursing students have mean scores which are

statistically significant difference in all aspect of concept mapping applications.

According to The students' responses to the satisfaction questionnaires about end of semester concept map usage are shown in **Table (2)**. The responses for each item were converted into 'agree' (answers of 'strongly agree' or 'agree') or 'disagree' (answers of 'strongly disagree' or 'disagree'), and were converted into mean and standard deviation (28.45) and (5.88) respectively. The data in figure (1) show that 95.7% of the students agreed that concept mapping helped them to learn nursing courses, and also integrate and clarify the inter-relationships among curriculum content. Ninety-five per cent of the students indicated that concept mapping stimulated them to learn and to think independently. The majority of students 95.7 % expressed the opinion that concept mapping helped them to reduce the barriers to learning and enhance their interests in learning such nursing courses& also believed that concept of mapping could be easily applied to other subject .theses opinion are consistent with successful examples of using concept of mapping in other disciplines (Chang *et al.,*2002, Harpaz *et al.,*2004, Freeman & Jessup, 2004, & Ahlberg *et al.,* 2005)

Although some students in this study expressed unsatisfying about the use of concept mapping as a learning style, their expression with using this learning method did not seriously hamper their success in the courses and they were represent a small percent (4.3%) of the whole sample as in **fig. (2).** The qualitative data presents evidence to suggest that this teaching strategy may have actually challenged students to use a new, unfamiliar, and comfortable approach, thus expanding their list of learning strategies and this congruent with Sadler-Smith, 1996 who mentioned that requiring assignments that meet the comfort level of students can motivate learning and enhance participation, but they can also suppress the development of other potentially effective methods of learning.

Concept mapping helped most students synthesize and reflect on topics covered in the course which evaluated through a concept map rubric method, and increase the quality of student concept maps, and ultimately, success in the course overall as shown in **table (3)** all students become able to organize their assignment contents while two thirds were exemplary in assembling the assignments' contents and about half of them become able to communicate the topics by exceeding standards that lead to overall presentation, most of student exceeds standard, and that supported with *Saouma & Attieh 2008 and Cravalho, 2010* through assuring that Creating concept map assignments with more specific instructions, geared toward conceptual understanding

and help facilitate greater overall academic improvements. Other study agreement with result. as Wallace and Mintzes (1990) stated, is the only approach to address both what students know and how students organize their knowledge. Furthermore, in the process of developing and modifying concept maps, students were required and were permitted to freely make connections, be creative and find new visual links. The concept mapping strategy thus offers a unique learning opportunity based on empowering students through knowledge of their own learning (**Leauby & Brazina, 1998**). In this regard, concept mapping is a useful meta-learning strategy in relation to helping students 'learn how to learn'.

Table (4) summaries the results of a t-test done to compare the mid-term exam and final exam score in intermediate accounting in the second semesters of 2012, and their scores in intermediate academic achievement pre-test. The results shown highly significant difference (t = .000**, *p<0.01*),this means improving academic performance after Appling concept of mapping ,and this result congruent with **Johnstone & Otis, 2006, and Bernstein, 2011**, That their findings indicated , the results in the general course assessment for group C students, who had used concept maps during the ten scenarios, scored (on average) about two percentage points higher than students in groups A and B who had acted as our control and final questionnaire administered to students in all three groups (90% return rate) a significant proportion of the control group & experimental group adopted concept mapping in their own studies of their own records, having heard the recommendations from their colleagues in the experimental group. The perceived challenge of the intellectual material that addressed the courses and assembling into a concept map correlated positively with the students' final courses' grades, with a statistically significant (.05).

Conclusion & Recommendations:

The findings of this study supported concept mapping as an effective learning strategy and has extended knowledge in the nursing education and also enhance student interests in learning nursing. Student also thought that concept mapping could be usefully used in other curriculum areas. A learning strategy, such as concept mapping can be effective for students with all kinds of learning style preferences, so further research study of the relationships between learning style preference and concept mapping as a teaching strategy is recommended. It is also recommended that nursing instructors could adopt concept mapping into course teaching and learning process. which may improve the nursing core competency, and if nursing instructors recognize the benefit and apply it to other subjects, the nursing students will be well prepared in

nursing competencies and be a good professional nurse in the future. The researcher also suggests replication of this study in other subjects, at other universities, and other competencies as well with using different research methodology as control group and experimental group. However further follow-up study of graduate nurses about the impact of concept mapping on acquiring nursing competencies should be initiated.

Corresponding author
Hanan .A. M. Youssef
Head of Nursing Department, Assistant Professor of Critical Care Nursing, Taif University
 dr_h_911@hotmail.com

References:

1. Ahlberg, M., Aanismaa, P., & Dillon, P. (2005). Education for sustainable living: Integrating theory, practice, design, and development. *Scandinavian Journal of Educational Research, 49*(2), 167–185.

2. Bernstein J. M. (2011), Concept Mapping And Student Success In A College-Level Environmental Studies Course, *A professional paper submitted in partial fulfillment of the requirements for the degree of Master of Science* in Science Education Montana State University ,Bozeman, Montana ,June2011

3. Biggs, J.B. (1988). The role of Metacognition in enhancing learning. *Australian Journal of Education, 32*(2), 127–138.

4. Chang,K.E.,Sung Y.T.,& Chiou S.K.,(2002) use of hierarchical hyper concept map in web-based courses. *Journal of Educational Computing Research*,27,335-353.

5. Chei-Chang Chiou, *Innovations in Education and Teaching International,* Vol. 45, No. 4, November (2008), 375–387 .

6. Cliburn, J.W. (1990). Concept maps to promote meaningful learning. *Journal of College Science Teaching, 19,* 212–217.

7. Cravalho, P. F. (2010) "Learning Statistics using Concept Maps: Effects on Anxiety and Performance" *San Jose State University*, patrickcravalho@yahoo.com, *Master's Theses*.
   3806.http://scholarworks.sjsu.edu/etd_theses/3806

8. Freeman, L.A., & Jessup, L.M. (2004). The power and benefits of concept mapping: Measuring use, usefulness, ease of use, and satisfaction. *International Journal of Science Education, 26*(2), 151–169.

9. Harpaz, I., B., C., & Ehrenfeld, M. (2004). Concept mapping: An educational strategy for advancing nursing education. *Nursing Forum, 39*(2), 27–30.

10. Hinck S. m. , , Webb P., Sims-giddens S., Helton C., § Hope k. l., , Utley O., , Savinske D., , Fahey E. m , and Yarbrough s., (2006), Student Learning With Concept Mapping Of Care Plans In Community-Based Education, *Journal of Professional Nursing*, Vol 22, No 1 (January–February): pp 23–29.

11. Jacobs-Lawson, J.M., & Hershey, D.A. (2002). Concept maps as an assessment tool in psychology courses. *Methods & Techniques, 29* (1), 25–29.

12. Jegede, O.J., Alaiymola, F.F., & Okebukola, P.A. (1990). The effect of concept mapping on students' anxiety and achievement in biology. *Journal of Research in Science Teaching, 27,*951–960.

13. Johnstone A. H. & Otis K. H. (2006), Centre for Science Education, University of Glasgow, Glasgow G12 8QQ, UK , Chemistry Education Research and Practice, 2006, **7** (2), 84-95, *The Royal Society of Chemistry,e-mail: alexjo@btinternet.com*

14. Kinchin, I.M. (2003). Effective Teacher–Student Dialogue: A Model From Biological Education. *Journal of Biological Education, 37*(3), 110–113.

15. Kinchin, I.M., De-Leij, F.A.A.M., & Hay, D.B. (2005). The Evolution of A Collaborative Concept Mapping Activity For Undergraduate Microbiology Students. *Journal of Further & Higher Education, 29*(1), 1–14.

16. Leauby, B.A., & Brazina, P. (1998). Concept Mapping: Potential Uses in Accounting Education. *Journal of Accounting Education, 16*(1), 123–138.

17. Meyer, J.H.F., & Shanahan, M.P. (2004). Developing Metalearning capacity in students: Actionable theory and practical lessons learned in first-year economics. *Innovations in Education and Teaching International, 41,* 443–455.

18. MacNeil, M. S. (2007). Concept Mapping as a Means of Course Evaluation. *Journal of Nursing Education*, *46* (5).

19. Novak, J. D. and A. J. Canas (2006). The Theory Underlying Concept Maps and How to Construct and Use Them. I. CmapTools.

20. Novak J. D. & Cañas A. J.,(2008), The Theory Underlying Concept Maps and How to Construct and Use Them, Florida Institute for Human and Machine Cognition, 2008, available at: *http://cmap.ihmc.us/Publications/*

21. Novak, J. D. (2002). Meaningful learning: The essential factor for conceptual change in limited or appropriate propositional hierarchies (liphs) leading to empowerment of learners. *Science Education, 86*(4), 548-571

22. Novak, J. D. (1990). Concept of Mapping :Auseful Tool for Science Education, *Journal of Research in Science Teaching*, 10, 923-949.

23. Preszler, R. W. (2004). Cooperative Concept Mapping Improves Performance in Biology. *Journal of College Science Teaching, 33*, 30-35.

24. Saouma B.e and Attieh M., The Effect of Using Concept Maps as Study Tools on Achievement in Chemistry American University of Beirut, Beirut, LEBANON, *Eurasia Journal of Mathematics, Science & Technology Education,* (2008), 4(3), 233-246.

25. Wallace, J.D., & Mintzes, J.J. (1990). The Concept Map as a Research Tool: Exploring Conceptual Change in Biology. *Journal of Research in Science Teaching*, 27, 1033–1052.

26. Yaowalak J.(2005), The Effectiveness of Using Concept Mapping to Improve Primary Medical Care Nursing Competencies among Fourth Year ,Faculty of Nursing Science, Assumption University ,Bangkok, Thailand, Assumption University Nursing Students, *AU J.T. 9(2): 111-120 (Oct. 2005)*.

10/9/2012