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CONCEPT MAPPING VERSUS TRADITIONAL TEACHING METHOD ON HEALTH SCIENCES' STUDENTS' SCORE

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Abstract

In the recent years, health care systems have been dynamically changing which demanded modifications in health care education. Current educational models are becoming more and more obsolete in enhancing the professional level of both teachers and students. Concepts maps are effective tools in processing large amounts of information, comprehending new concepts, as well as in generating information and amplifying creativity levels. The aim of this study is to compare the concept mapping versus traditional teaching method on Health Sciences' students' score. A Quasi-experimental design was implemented in the study. The study revealed that there was a significant difference between learning by traditional method and by concept mapping that can be a predictor of better academic achievement. Concept maps prove to be an efficient teaching-learning method in health sciences education.

Keywords

Teaching, Learning, Concept Mapping, Academic Achievement, Education

1. INTRODUCTION

In the past few decades, changes in health care delivery and advances in medicine have increased demands on academic faculty, resulting in less time for teaching than has previously been the case. (Ozuah PO, 2007). The process of medical education consists of equipping the student with contemporary technical and scientific knowledge and to mold them to be the right kind of person in order to apply this knowledge, as a professional, to individuals and communities. Currently, many universities seek better ways to enhance their educational technologies that, according to the UNESCO documents, should provide novel organizational arrangements for creation, application, and defining teaching, learning, and assessment processes and resources with their common integration (Vodovozov V & Raud Z, 2015).

The main aim is to arrange high quality educational tool to encourage students to learn proficiency in their field as well as the supplementary knowledge in the professional working environment (Vodovozov V & Raud Z, 2015).

Many studies focus on the approaches to increase understanding of the large volumes of information. Contemporary curricula management became inappropriate for both the teachers and the students who require regular enhancing of their professional level. To overcome such limitations, the new methods were developed in the global teaching practice. Concept maps are powerful graphical tools for the knowledge acquisition created by Joseph D. Novak and his team at Cornell University in the 1970's. Concept maps are based on Ausubel's learning theory and have been used by many disciplines to organize and represent knowledge and enhance meaningful learning (Shieh CJ et al., 2014).

Concept maps stimulate the generation of ideas, and help improving one's own creativity. They incorporate ideas typically encased in circles or boxes interconnected by lines that are linked to concepts. Words on the lines represent the linking expressions. The concept maps support students in understanding the novel topics by mapping the links among new and previously studied domains (Guastello EF et al., 2000, Thanasis G et al., 2014). Since their development, concept maps have been shown to be useful for Giving an outline judgment of a person's existing information, Recognizing Confusions, revealing understanding gaps, pushing reflective intuition, designing curricula and instructional materials, assessing student learning, evaluating program effectiveness, facilitating communication and arriving at shared understandings among members of groups, understanding the processes by which scientists construct new knowledge, and studying problems in epistemological foundations and assumptions (Mintzes JJ et al., 2005, Novak JD et al., 1983, Novak JD & Gowin DB, 1984). Therefore, the aim of this study is to compare the Concept Mapping Versus Traditional Teaching Method on Health Sciences' students' score.

2. MTHODOLOGY

2.1 Design

A Quasi-experimental Design was implemented in the study.

2.2 Sample and Settings

This study was conducted at the Faculty of Health Sciences involving the four departments. A sample of 100 undergraduate students from four programs; physical therapy, medical laboratory sciences, nursing and nutrition were included in the study and were distributed between the control and experimental group. The inclusion criteria that enroll this study require that all students are undergraduate, are taking or have taken the Epidemiology and Biostatistics course, and all students are aged 17 years old and above. Students were excluded if they were not well prepared or did not have previous experience in learning by concept mapping.

2.3 Questionnaires

The researchers in a manner that fit the study needs and criteria, developed a Socio-Demographic questionnaire; including the participants' age, gender, marital status, previous experience in teaching, previous learning by concept mapping method.

The researchers also used the Student Feedback Scale Questionnaire to measure student satisfaction and experience in concept mapping. In addition, the researchers measured the academic achievement by administering the same exam for the control and experimental group and checking their score grade.

2.4 Statistical Analysis

Data was analyzed by SPSS program Version 20 and tabulated using the numbers and percentage distribution. Significance level was set at $P<0.05$. The data was analyzed, using both parametric and non-parametric tests such as; Mann-Whitney, Chi square, Fisher Exact test, Monte Carlo, independent t-test and chi-square.

3. RESULTS

The overall sample incorporated 100 health sciences students including nursing (18%), physical therapy (33%), nutrition (17%), and medical lab students (32%), where 47% where younger than 21 years old and 53% where older. The majority of the participants where females (78%), while 22% of the sample was made up of males. It is noteworthy that almost all the participant (995) were single while only one student was married. Only 30% of the students had previous experience in teaching and 71% of them had no experience in learning through concept maps. 75% of the participants where juniors while 25% were seniors, and it is important to note that 72% of the students reported being averagely prepared for the exam while 28% reported being well prepared (Table1).

Table 1: Comparison between of the two-studied group according to socio demographic data.

	Total (n=100)	Traditional Method (n=47)	Concept mapping method (n=53)	χ^2	p
Age					
<21	47 (47%)	20 (42.6%)	27 (50.9%)	0.704	0.401
≥21	53 (53%)	27 (57.4%)	26 (49.1%)		
Gender					
Male	22 (22%)	11 (23.4%)	11 (20.8%)	0.102	0.750
Female	78 (78%)	36 (76.6%)	42 (79.2%)		
Marital status					
Single	99 (99%)	46 (97.9%)	53(100%)	1.139	$^{FE}p=$ 0.470
Married	1 (1%)	1 (2.1%)	0 (0%)		
Previous experience in teaching					
No	70 (70%)	37 (78.7%)	33 (62.3%)	3.213	0.073
Yes	30 (30%)	10 (21.3%)	20 (37.7%)		
Previous learning By concept mapping method					
No	71 (71%)	34 (72.3%)	37 (69.8%)	0.077	0.781
Yes	29 (29%)	13 (27.7%)	16 (30.2%)		
Department					
Physical therapy	33 (33%)	10 (21.3%)	23 (43.4%)	13.995*	0.003*
Nursing	18 (18%)	15 (31.9%)	3 (5.7%)		
Medical laboratory	32 (32%)	13 (27.7%)	19 (35.8%)		
Nutrition	17 (17%)	9 (19.1%)	8 (15.1%)		
CGPA					
NA	38 (38%)	18 (38.3%)	20 (37.7%)	1.808	$^{MC}p=$ 0.645
<2	3 (3%)	2 (4.3%)	1 (1.9%)		
2-3	44 (44%)	22 (46.8%)	22 (41.5%)		
>3	15 (15%)	5 (10.6%)	10 (18.9%)		
Academic level					
1st year	38 (38%)	18 (38.3%)	20 (37.7%)	20.284*	^{MC}p <0.001*
2nd year	37 (37%)	15 (31.9%)	22 (41.5%)		
3rd year	16 (16%)	14 (29.8%)	2 (3.8%)		
4th year	9 (9%)	0 (0%)	9 (17%)		
Junior	75 (75%)	33 (70.2%)	42 (79.2%)	1.084	0.298
Senior	25 (25%)	14 (29.8%)	11 (20.8%)		

Continue Table 1

How do you evaluate your preparedness for the exam					
Average	72 (72%)	35 (74.5%)	37 (69.8%)	0.268	0.605
Well prepared	28 (28%)	12 (25.5%)	16 (30.2%)		

Qualitative data were described using number and percent and was compared using Chi square test or Fisher Exact test or **Monte Carlo** test

*: Statistically significant at $p \leq 0.05$

A chi-square test was carried out to determine if there is a difference between the two groups on the level of sociodemographic data and other participant characteristics and factors. The results showed no significant difference on the level of all factors except on the level of preparedness for the exam, where a P-value of P=0.03 was recorded (Table 2).

Table 2: Relation between score with socio demographic data.

	Total (n=100)	**Score**		χ^2	**p**
		>7 (n=62)	**≤7 (n=38)**		
Age					
<21	47 (47%)	28 (45.2%)	19 (50%)	0.221	0.638
>21	53 (53%)	34 (54.8%)	19 (50%)		
Gender					
Male	22 (22%)	16 (25.8%)	6 (15.8%)	1.378	0.241
Female	78 (78%)	46 (74.2%)	32 (84.2%)		
Marital status					
Single	99 (99%)	62 (100%)	37 (97.4%)	1.648	$^{FE}p=$ 0.380
Married	1 (1%)	0 (0%)	1 (2.6%)		
Previous experience in teaching					
No	70 (70%)	46 (74.2%)	24 (63.2%)	1.366	0.242
Yes	30 (30%)	16 (25.8%)	14 (36.8%)		
Previous learning By concept mapping method					
No	71 (71%)	47 (75.8%)	24 (63.2%)	1.831	0.176
Yes	29 (29%)	15 (24.2%)	14 (36.8%)		
Department					
Physical therapy	33 (33%)	20 (32.3%)	13 (34.2%)	4.092	0.252
Nursing	18 (18%)	11 (17.7%)	7 (18.4%)		
Medical laboratory	32 (32%)	17 (27.4%)	15 (39.5%)		
Nutrition	17 (17%)	14 (22.6%)	3 (7.9%)		
CGPA					
NA	38 (38%)	24 (38.7%)	14 (36.8%)	1.281	$^{MC}p=$ 0.817
<2	3 (3%)	1 (1.6%)	2 (5.3%)		
2-3	44 (44%)	28 (45.2%)	16 (42.1%)		
>3	15 (15%)	9 (14.5%)	6 (15.8%)		
Academic level					
1st year	38 (38%)	24 (38.7%)	14 (36.8%)	3.777	0.287
2nd year	37 (37%)	20 (32.3%)	17 (44.7%)		
3rd year	16 (16%)	10 (16.1%)	6 (15.8%)		
4th year	9 (9%)	8 (12.9%)	1 (2.6%)		
Junior	75 (75%)	44 (71%)	31 (81.6%)	1.415	0.234
Senior	25 (25%)	18 (29%)	7 (18.4%)		
Evaluation of preparedness for the exam					
Poorly prepared	0 (0%)	0 (0%)	0 (0%)	4.533*	0.033*
Average	72 (72%)	40 (64.5%)	32 (84.2%)		
Well prepared	28 (28%)	22 (35.5%)	6 (15.8%)		

FE: Fisher Exact. MC: monte Carlo.

Qualitative data were described using number and percent and was compared using Chi square test or Fisher Exact test or **Monte Carlo** test. *: Statistically significant at $p \leq 0.05$

A Mann Whitney test was carried out to detect if there is any difference between the control and experimental group on the level of the score. The results showed that there was a highly significant difference where a p-value of P<0.001 was recorded.

Table 3: Comparison between of the two-studied groups according to score.

Score	Total (n = 100)	Traditional Method (n=47)	Concept mapping method (n=53)	U	p
Min. – Max.	3 – 10	3 – 10	6 – 10		
Mean ±SD.	8.1 ± 1.8	7.2 ± 1.6	8.9 ± 1.5	510.50*	<0.001*
Median	8.5	7.0	10		

U, p: U and p values for **Mann Whitney test** for comparing between the two groups.

*: Statistically significant at $p \leq 0.05$.

Moreover, multivariate regression analysis was carried out to determine the factors that might predict a better performance and higher course score among health sciences students. The results showed that learning by concept mapping was a significant predictor of higher recorded score among the students where a P-value of P<0.001 was noted.

Table 4: Multivariate analysis logistic regression for factor affecting score.

	B	SE	P	OR	95% CI LL	95% CI UL
Concept Mapping	4.042	1.110	<0.001*	56.955	6.472	501.227
Department						
Physical therapy®			0.608			
Nursing	0.651	1.461	0.656	1.917	0.109	33.589
Medical laboratory	1.276	0.946	0.177	3.583	0.561	22.896
Nutrition	0.985	1.248	0.430	2.678	0.232	30.928
Academic level						
4th year®			0.956			
1st year	0.447	1.159	0.700	1.564	0.161	15.172
2nd year	-0.118	0.949	0.901	0.888	0.138	5.706
3rd year	0.194	1.682	0.908	1.214	0.045	32.827
How do you evaluate your preparedness for the exam						
Well prepared®						
Average	1.215	0.749	0.105	3.371	0.776	14.647

B: Unstandardized Coefficients, OR: Odds ratio, CI: Confidence interval, LL: Lower limit, UL: Upper Limit.

*: Statistically significant at $p \leq 0.05$.

Finally, Table 5 represents the students' satisfaction with the concept mapping learning experience and it shows that the majority of students were satisfied by learning through concept mapping.

Table 5: Students' feedback on different aspects of concept mapping (using the Likert scale).

Number	Item	% Agree or strongly agree
1	Concept maps helped me to learn and identify key concepts of the topic	84%
2	Concept mapping helped me to connect the various concepts with each other	85%
3	Concept maps helped me to rectify the misconceptions about the topic	77%
4	Concept mapping activity is useful in understanding in memorizing/ recalling/visualizing the various key concepts	84%
5	Concept mapping is useful activity for study and revision	93%
6	Concept maps help in arranging more logical flow of concepts	88%
7	Concept mapping helped me to see 'Big picture' of the topic	77%
8	Concept mapping activity is useful to me and to apply to other subjects in near future	87%
9	I have enjoyed concept mapping activity	86%

4. Discussion

This study showed that concept mapping is a more effective teaching learning strategy than the traditional method, to improve academic achievement of the students, where the results showed that the mean score of academic achievement after application of concept mapping in the intervention group was more than the mean score recorded by the control group. The results of this study are also consistent with the findings of a study stated that concept mapping provides the opportunity for active involvement of students in their learning process (Cheema AB & Mirza MS, 2013). This is also consistent with the results of another study (Udeani U & Okafor PN, 2012) where the experimental group involved in concept mapping was found to achieve significantly better than their control group counterparts in the biology achievement post-test.

Moreover, the results are in agreement with the findings of a study that studied the effect of using concept mapping on the academic achievement of accounting students, which reported that students using concept maps performed better than those using traditional method (Chiou CC, 2008). Furthermore, (Sakiyo J. & Waziri K, 2015) found out that students taught biology concepts using concept mapping method performed better than those taught with lecture method. The findings of this study also agree with findings of another study that found significant difference between experimental and control groups in favor of concept mapping group (Akeju OS et al., 2011).

On the other hand, another study found that there was an effect by concept mapping as study tools on achievement in chemistry lectures. In that study, results showed that while there were no significant differences on the achievement total score, there were significant differences favoring the experimental group for scores on the knowledge level questions (BouJaoude S & Attieh M, 2008).

The results was also in agreement with a study conducted to find out the effect of concept mapping on students' academic achievement at elementary level in the subject of general science where results have shown that concept mapping is a more effective teaching learning strategy than the traditional method (Cheema AB & Mirza MS, 2013).

The results of this study showed that there was no significant difference between males and females regarding academic achievement upon the application of concept mapping. This is consistent with the study that revealed no gender difference in the use of concept mapping for meaningful learning (Ahlberg M & Ahoranta V, 2004). The results of the study at hand is consistent with a study that found no gender difference in students' achievement in biology and suggested that, gender differences can be eliminated when teachers used certain teaching strategies that can bring about gender equity in science education (Sakiyo J & Waziri K, 2015). However, another study found that concept mapping was favored by males rather than females (Karakuyu Y, 2010), in consistence with the study by (Cheema AB & Mirza MS, 2013).

The significant interactions between concept mapping and gender can be interpreted in light of the cognitive style theory that categorizes males and females into different learning styles. The better performance of female students is also reported on use of concept mapping as study tool in Chemistry and Biology in 10th grade from a co-educational private high school in Lebanon (Boujaoude & Attieh, 2003).

The results of this study are consistent with a study that investigated the interaction between gender and the effect of concept mapping as a teaching method and found no significant interactions between gender and groups; whether control or intervention group (Karakuyu Y, 2010).

Moreover, the results of this study revealed a highly significant positive correlation between instruction using concept mapping and student satisfaction. These findings are consistent with another study established that concept had received satisfaction from students' responses and also showed that most of the students agreed that concept mapping combined with flash animation broke the traditional teaching barriers to inspire students' learning interests and enthusiasm for learning. In other words, students were able to easily catch up to the subject matters and the concepts through concept mapping instruction. Moreover, that study showed that students even agree to design the concept-mapping diagram on their own and extend the construct to other professional fields. It fully explains that the concept mapping combined with computer auxiliary is a practical instruction tool to be applied in any other subjects besides science-based fields (Tseng et al., 2009).

Furthermore, the results of this study are also supported by a study that showed that the experimental group was positive about the usefulness of concept mapping in enhancing learning effectiveness after they took the concept-mapping course. Almost all students expressed the view that the concept mapping strategy was helpful for learning accounting and understanding the structure and inter-relations of the curriculum content (Chiou CC, 2008). The opinions of students support the merit of concept mapping in the integration of knowledge (Åhlberg M et al., 2005, Kinchin IM et al., 2005, Lavigne NC, 2005, Shavelson RJ et. 2005). The original intent of the concept mapping strategy (Åhlberg M et al., 2005, Kinchin IM et al., 2005, Lavigne NC, 2005, Shavelson RJ et al., 2005, Harpaz I et al., 2004) was to facilitate students' independent learning and thinking. The views of students in this study are in agreement with this idea. Furthermore, most students pointed out that adopting the concept mapping strategy helped them reduce the barriers and promote their interests in learning. In terms of affective acceptance, the experimental group had an affirmative attitude for using the concept mapping strategy. The overwhelming majority of the students were of the opinion that concept mapping can be a feasible instructional strategy. Most of the students liked, and felt satisfied with, adopting concept mapping as an assistive learning strategy. The students in the concept-mapping group also believed that concept mapping could be easily applied to other subjects. These opinions are consistent with the successful examples of using concept mapping in other disciplines (Åhlberg M et al., 2005, Chang KE et al., 2002, Freeman LA & Jessup LM, 2004, Ritchie D & Volkl C, 2000).

Consequently, with positive feedbacks and negative shortages, students still agree that concept mapping instruction did improve their learning performance, thinking abilities, and problem solving abilities as well. Students were willing to continue applying concept-mapping approach into other subjects even though the beginning works were somewhat hard for them.

Likewise, the present study implied that concept maps could be useful in preparation for classes and examinations. Suggestions that graphical demonstration of concepts and the relationships between them has potential for assisting memory and recall, as most humans have a higher capacity for recalling visual images than specific verbal details (Novak JD & Gowin DB, 1984). Participants' positive perceptions about concept maps as a preparation aid for exams and concept maps significant prediction of exam score suggest that the concept maps strategy can be incorporated into the preparation courses for centralized examinations (e.g., KPSS etc.).

The whole experimental group was more positive about the usefulness of concept mapping in enhancing learning effectiveness after they took the concept mapping course. Almost all students expressed the view that the concept mapping strategy was really helpful for learning accounting and understanding the structure and inter-relations of the curriculum content. The opinions of students support the merit of concept mapping in the integration of knowledge (Novak JD & Gowin DB, 1984; Åhlberg M et al., 2005, Kinchin IM et al., 2005, Lavigne NC, 2005, Shavelson RJ et. 2005). The original intent of the concept mapping strategy was to facilitate students' independent learning and thinking (Novak JD et al., 1983, Novak JD & Gowin DB, 1984, Åhlberg M et al., 2005). The views of students in this study are in agreement with this idea. Furthermore, most students pointed out that adopting the concept mapping strategy helped them reduce the barriers and promote their interests in learning accounting. In terms of affective acceptance, the experimental group had a more affirmative attitude for using the concept mapping strategy. The overwhelming majority of the students were of the opinion that concept mapping can be a feasible accounting instructional strategy. Most of the students liked, and felt satisfied with, adopting concept mapping as an assistive learning strategy. The students in the concept mapping group also believed that concept mapping could be easily applied to other subjects. These opinions are consistent with the successful examples of using concept mapping in other disciplines (Åhlberg M et al., 2005, Chang KE et al., 2002, Ritchie D &Volkl C, 2000).

5. CONCLUSION

The development of concept maps allows students to see how ideas are connected. It can be an effective teaching– learning strategy that allows a student to develop the ability to organize and group information in a meaningful way. Further, most students were satisfied with this strategy to learn how their clients' health existed in context to a situation. Concept maps are effective tools for making the structure of knowledge explicit.

Therefore, it is hoped that by sharing this information, educators will attempt to increase the use of concept mapping during curriculum planning. This learning, teaching and assessment approach will give the students an opportunity to participate in for a more comprehensive learning process that is very relevant to the professional practice requirements.

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