Journal of Business, Economics and Finance (JBEF), ISSN: 2146 - 7943

Journal of Business, Economics and Finance

Year: 2016 Volume: 5 Issue: 2

THE EFFECTS OF USING THE CONCEPT MAPPING AND THE TRADITIONAL METHOD ON THE ACADEMIC ACHIEVEMENT OF STUDENTS IN LEARNING THE FUNDAMENTAL TOPICS OF COST ACCOUNTING

DOI: 10.17261/Pressacademia.2016219260

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ABSTRACT

This paper aims to compare the effects of using the concept mapping and the traditional method on the academic achievement of students in learning the fundamental topics of cost accounting. The study is based on a quasi-experimental pattern with a matched pretest-posttest control group. The sample group was distributed to the observation (concept mapping) group and the control (traditional method) group as twenty-eight students for each group. The differences between the pre and post tests' score averages revealed that the observation group performed better as the score averages of the observation group decreased less than that of the control group (0.68<3.00). The results show that the concept mapping is more effective on the academic achievement levels of the participating students.

Keywords: Concept mapping, cost accounting, education, meaningful learning.
JEL Classification : I21, M41, M49

1. INTRODUCTION

This study is based on the authors' efforts to reach meaningful learning rather than rote learning in cost accounting classes. During the lectures, the authors noticed that the students had a tendency towards memorizing instead of comprehending; when associated with Bloom's Taxanomy of Learning Domains (Bloom, Engelhart, Furst, Hill and Krathwohl, 1956), this tendency led the authors to pursue the means of promoting higher forms of thinking in education including the analyzing and evaluating concepts, processes, procedures, and principles. Concept mapping stood out as a conspicuous method in this context.

Concept maps are defined as "graphical tools for organizing and representing knowledge" (Novak and Cañas, 2008, p. 1). Based on the learning psychology of David Ausubel (1963; 1968; Ausubel, Novak and Hanesian, 1978), the fundamental idea in cognitive psychology evolved into concept maps in 1972 in the course of J. D. Novak's research program at Cornell University. Novak by himself (1977, 1990, 1991, 1993, 1998, 2002) and together with some other authors (Novak and Gowin, 1984; Novak and Musonda, 1991; Novak and Wandersee, 1991) developed concept mapping, over decades, as a matured method in teaching and learning.

Depending on this background, the aim of this paper is to compare the effects of using concept mapping and traditional method[1] on the academic achievement of students in learning the fundamental topics of cost accounting. To this end, a research was based on a quasi-experimental pattern with a matched pre test-post test control group. Fundamental topics of cost accounting including basic concepts, overall manufacturing costs, activity-based costing, job costing and process costing were incorporated.

[1] Traditional method: Lecturer presentation followed by question & answer sessions.

The paper consists of four sections including the introduction where the background of the study is explained. Then a literature review is revealed with two subsections as accounting and education-related studies. In the third section, the research methodology is exhibited with findings of the research and in the fourth section, the study is concluded with some recommendations for future studies.

2. LITERATURE REVIEW

Over decades, researchers gave an in-depth look to concept mapping through various subjects. Pointing to the goal of this study, relevant literature was reviewed under two subtitles; *accounting-related studies* and *education-related studies* incorporating topics such as learning improvement, decision making, developing curriculum, organizing knowledge, learning assessment and teaching process.

2.1. Accounting Related Studies

Some studies associated concept mapping with learning assessment in accounting education. Litherland, Carmichael and Martinez-Garcia (2013) studied upon an ontology-based e-assessment system in accounting. Their system was called OeLe and used a 'concept map' or 'ontology' of the domain knowledge expressed by subject specialists. Their paper described the potential affordances and demands of the ontology-based assessment. In his paper, Kirkham (2013) presented a theoretical model to address the design and assessment of the accounting practice sets that would enhance learning and provide clearer learning outcomes for first year accounting students, and he noted concept mapping as an enriching learning tool. Ku, Shih and Hung (2014) studied the integration of the idea of concept map into dynamic assessment model for accounting education in vocational high school. The results show that after the intervention of computerized dynamic assessment system, posttest scores were significantly higher than pretest scores. In addition, regardless of learning styles, when students were willing to commit time to follow the guidance, they could result in a good learning progress. Simon (2007) also assessed the usefulness of concept mapping within an accounting education context, but per contra, he did not find any significant differences in the usefulness of the method for students of different ages and genders, yet Asian students generally found the method to be more useful than did the UK students.

A group of researchers approached concept mapping through various aspects of learning such as learning level, learning enhancement and improvement. Chiou (2008) examined whether concept mapping could be used to help students improve their learning achievement and interests. The study indicated that, adopting a concept mapping strategy could significantly improve students' learning achievement compared with the use of a traditional expository teaching method. The study also revealed that most of the students were satisfied with using concept mapping in an advanced accounting course. Ertan, Yucel and Sarac (2014) measured the contribution of concept mapping technique to the effect on students learning level in accounting lessons. They found that concept maps increased the students' achievement. In their paper, Greenberg and Wilner (2015) provided a framework for integrating topics in the cost/managerial accounting course to enhance learning and a detailed discussion of how to proceed with the concept maps as building blocks in the course. Leauby, Szabat and Maas (2010) used concept mapping experimentally in an introductory financial accounting course and tested the hypothesis that student learning in an introductory financial accounting course increases, as measured by examination scores, when traditional methods of instruction are supplemented by concept mapping activities. Their results addressed no statistically significant evidence supporting the stated hypothesis.

Simon (2009, 2010, 2015) diversified his research as to concept mapping and accounting with matters like enriching the understanding, developing curriculum and student participation. Simon (2009) noted concept mapping as a method of making the dialogue between lecturer and student effective and explicit so both can fully participate in the construction of shared understanding. In another study, Simon (2010) described how curriculum concept mapping had been used to assist making changes to an accounting theory module. He concluded that curriculum concept mapping should be useful to support faculty, of all levels of experience, to consider and reconsider both accounting and non-accounting curricula. Simon (2015) also demonstrated how the tool can be used by students to construct their own concept maps and how educator-constructed concept maps can be used as quizzes to encourage more student participation in class.

2.2. Education Related Studies

Education related concept mapping studies display a variety of research topics. Some researchers dealt with assessment issues; Kandiko, Hay and Weller (2012) discussed how mapping techniques were used in university teaching in a humanities subject. They expanded the use of concept mapping as a pedagogical tool, with a focus on reflective learning processes and suggested ways of application of concept maps as a learning and assessment tool to assist the writing and reflection process in the humanities. In their study, Ruiz-Palomino and Martinez-Canas (2013) evaluated concept mapping as a learning tool for the assessment of business management degree students. Soika and Reiska (2014) searched for evidence as to whether the use of concept mapping as an assessment tool could be helpful in measuring meaningful concept acquisition. They concluded that concept mapping method is valid and reliable.

Some other researchers delved into learning issues in concept mapping; Hay, Kinchin and Lygo-Baker (2008) described how concept mapping could be used to transform abstract knowledge and understanding into concrete visual representations that were amenable to comparison and measurement. Their results demonstrated how the quality of learning could be significantly enhanced by the use of concept mapping. Chiou (2009) examined whether a concept mapping strategy could be useful in helping students to improve their learning performance in a business and economics statistics course. The experimental results suggested that adopting a concept mapping strategy can significantly improve student learning achievement in statistics, compared to using traditional textbook exercises, and adopting a collaborative concept mapping improves student achievement even more than using individual concept mapping. Katiliūtė and Daunorienė (2011) asked the opinions of students about the concept mapping task in quality management. The results appeared to indicate that the use of concept maps within a quality management course stimulated meaningful learning and promoted the development of students' learning strategies both individually and as a group. Wu, Hweng, Milrad, Ke and Huang (2012) proposed a computer-based concept map-oriented learning strategy with real-time assessment and feedback. They found their approach could be significantly beneficial to promote learning achievements as well as the learning attitudes of students. Surapaneni and Tekian (2012) introduced concept maps with clinical cases to improve learning of biochemistry course content. Their results revealed higher academic performance with concept mapping compared to the traditional course. Tseng, Chang, Lou, Tan and Chiu . (2012) investigated students' perception of concept maps as a learning tool where knowledge transfer was the goal. Their results revealed that positive concept-mapping perception was helpful for knowledge transfer in five learning stages: acquisition, communication, application, acceptance, and assimilation. Daugherty, Custer, and Dixon (2012) conducted a focus group study to better understand how technology/engineering educators could use concept mapping. They revealed that concept mapping could help technology and engineering teachers to facilitate learning and provide evidence of understanding throughout a learning experience. Elorriaga *et al.* (2013) aimed to test collaborative concept mapping activities using computers in a classroom scenario and to evaluate the possibilities that Elkar-CM[2] offers for collaboratively learning non-technical topics. Results revealed that students evaluated the collaborative concept mapping activities positively and Elkar-CM was evaluated as a suitable tool for collaborative concept mapping. In her paper, Smith (2014) recommended problem-based learning and concept mapping to promote student learning of basic and higher-order thinking skills. Von der Heidt (2015) explained the application of concept mapping to help foster a learning centered approach. She investigated how concept maps are used to measure the change in learning. Her results provided strong evidence for improvement in students' ability to externalize new learned concepts resulting from intensive instruction.

In some studies decision making and critical thinking were seen to be associated with concept mapping. Maas and Burgess-Wilkerson (2012) presented a student concept mapping guide as a template for use in an undergraduate management course, specifically in business communication. They noted that concept mapping is well-entrenched across a wide range of disciplines as an innovative learning tool to improve students' abilities to think in more holistic terms. Harris and Zha (2013) assessed the efficacy of concept mapping for facilitating critical thinking in four sections of an introductory psychology course. They found evidence supporting the construction of concept maps as a strategy for facilitating critical thinking. Kemer, Borders and

[2] Elkar-CM is a multi-lingual and multi-media software program designed for drawing concept maps (CMs) collaboratively.

Willse (2014) concentrated on cognitions of expert supervisors as to preparing, conducting and evaluating their supervision sessions through concept mapping, and found that concept mapping yielded remarkable results for expertise in counseling supervision. Van Bon-Martens *et al.* (2014) aimed to explore the suitability of concept mapping method as a tool to integrate practical knowledge with scientific knowledge in order to improve theory development as a sound basis for practical decision-making. They concluded that in four of the five studies, the resulting concept map was received as a sound basis for practical decision-making. Moattari, Soleimani, Moghaddam and Mehbodi (2014) aimed to determine the effect of clinical concept mapping on discipline-based critical thinking of nursing students. Results of their study revealed a significant difference between the experimental and control groups' critical and cognitive thinking skills and habits of mind regarding identification, justification, and quality of responses. Hassan, Al Somaili, Al Khathami, Al Ghobain and Bin Salih (2015) studied upon improving evidence implementation through cognitive interventions using concept maps which enhance analytical thinking and decision making. They concluded that generic concept maps improved trainees' diagnostic labeling, management and decision-making process.

If organizing knowledge is to be evaluated in the same context, Tseng, Chang, Lou and Hsu (2013) explored that using creative problem solving could promote students' performance of concept mapping. The results showed that meaningful high-level learners successfully applied creative problem solving in constructing concept maps and they presented better performance of concept mapping. In their study, Tanenbaum and Antle (2009) investigated the use of a tangible user interface to engage learners in concept map creation. They described a prototype implementation of the system, presented some preliminary analysis of its ease of use and effectiveness, and discussed how elements of tangible interaction supported concept mapping by helping users organize and structure their knowledge about a domain. They noted the role of physical engagement and embodiment in supporting the mental activity of creating the concept map.

Davies (2011) studied enriching the understanding and offered an outline of the various types of mapping tools available with their advantages and disadvantages. His study supported concept mapping as a tool to enrich understanding, and proposed the use of software to construct maps. Batdi (2014) focused on academic achievement aimed to determine the effect of using concept-mapping technique and traditional methods on the achievement, retention and attitudes of students through meta-analysis. His research showed that concept-mapping technique had a positive and large effect on academic achievement and retention.

Kaşlı, Aytaç and Erdur (2001) introduced concept mapping as a technique utilizing teaching process through information and application examples especially in group working-cooperation environment. Chen and Wang (2012) presented a student-centered teaching model based on concept mapping and problem-solving. They used concept maps as a tool for developing curriculum and evaluating teaching performance.

Rosas and Kane (2012) and Kinchin (2015) made an overview of the relevant literature. Kinchin (2015) aimed to reexamine conclusions drawn by recent analyses of the literature on concept mapping as an educational tool by considering the wider literature on curriculum development, and offered enhanced guidance on the contextualization of concept mapping. Rosas and Kane (2012) conducted a pooled analysis of 69 concept mapping studies to describe characteristics across study phases, generate specific indicators of validity and reliability, and examine the relationship between the selected study characteristics and quality indicators. Results suggested that concept mapping yielded strong internal representational validity and very strong sorting and rating reliability estimates.

3. DATA AND METHODOLOGY

In this section, the research methodology, participants and measurements and assessments of the study are interpreted.

3.1. Methodology

During the research, concept mapping and the traditional method were used, concept mapping studies were executed as after class sessions with the participation of observation group only. The plan, method, activities and materials prepared for the observation group were determined relative to the concept mapping method

while the plan, method, activities and materials prepared for the control group were determined relative to the traditional method. Independent variables had similar effects on the two groups.

The research was executed during the 2015 spring semester at Bandirma Onyedi Eylul University, Faculty of Economic and Administrative Sciences, Business Management Department. Learning and teaching techniques in accordance with concept mapping and the traditional method were used. Fundamental topics of cost accounting such as basic concepts, overall manufacturing costs, activity-based costing, job costing, process costing were incorporated.

The research was based on a quasi-experimental pattern with a matched pre test-post test control group. Pre and post tests were formed from the very same questions for the sake of consistency; however, the participants were not informed as to this connection. All participating observation and control group students attended to both pre and post tests. The pre test was executed with an aim to determine whether the academic achievement of students in both observation and control groups were well-matched, and to indicate the improvement level, if any had accrued. The post test was executed in order to demonstrate the effectiveness of the concept mapping method. Both tests consisted of three questions, each question was worth four points with twelve points overall. Table-1 below displays the research pattern.

Table 1: Research Pattern

Group	Before Working Group	Teaching-Learning Method	After Working Group
Observation Group	Pre test	Concept mapping	Post test
Control Group	Pre test	Traditional	Post test

3.2. The Participants

For the purpose of the research, the sophomore (third grade) class business management students from Bandirma Onyedi Eylul University, Faculty of Economic and Administrative Sciences were chosen as the study group. The observation and control groups were then formed out of the study group students.

Because extracting chance of the sample units from the universe was not equal, the Non-Random Sampling Method was preferred. In order to select the information–rich cases for in-depth study with regard to the aim of the research, the Purposeful Criterion Sampling was used.

The universe of the research was formed by the sophomore class business management students from Bandirma Onyedi Eylul University, Faculty of Economic and Administrative Sciences in Spring 2015 semester. The sample group included fifty-six students selected from this universe with respect to their grades of Cost Accounting-I Course at Fall 2015 semester on condition of being CB and better. The grade point averages and the GPAs of these students varied between 2.00 to 4.00. Because these fifty-six students were homogeneous as to their academic achievements, they were distributed to the observation and control groups equally as twenty-eight students for each group.

The study group students gained up to 10% credits for the Cost Accounting-II course according to their number of attendance over fourteen weeks as a promotion for participation.

3.3. Measurements and Assessments

Throughout the fourteen week spring semester, all the participating study group students attended to the usual cost accounting course over three hours a week. In the course of these regular lessons, the traditional method of teaching and learning was conducted. The observation group, more than that of the control group, attended to additional one and a half hours of concept mapping working group weekly. Working group schedule is given in Appendix 1.

Twenty-eight students participating to the observation group were distributed into four subgroups consisting seven students in each, and subgroups A, B, C and D were formed.

The observation group studies began with an introduction of concept mapping notion and method, the students were then introduced with the aim, limitations and methodology of the research, finally the instances of incorporating cost accounting topics with concept mapping were exemplified by the lecturers. Students in the observation group were given take-home working topics in order to prepare appropriate concept maps for each topic. The observation group students then presented the concept maps they had prepared to the study group on a weekly basis. Examples of the concept maps prepared by the observation group participants are given in Appendix 2.

Since pre and post tests were formed from the very same questions for the sake of consistency, both tests consisted of three questions, each question was worth four points with twelve points overall. While evaluating the post test, the points were given to the observation group students for the correct listings of the concepts and the objects/events, and for their reasonable allocations at the individual concept maps. Students participating to the observation group were asked to answer the post test questions using the concept maps, and the control group were asked to answer the questions in a multiple-choice form. The points were given to the control group students for every correct choice they made.

4. FINDINGS AND DISCUSSIONS

Table-2 displays the pre and post test scores, grades from the courses of Cost Accounting-I and Cost Accounting-II, and the GPAs of the students in the observation and control groups (See Table 2 in Appendix 1). Students' GPAs vary between 2.00 and 4.00. Twenty-eight of the participating fifty-six students' GPAs are between 2.00 and 3.00, while the remaining twenty-eight participants' GPAs are higher then 3.00. As for the grades from the courses of the Cost Accounting-I and Cost Accounting-II, the participants' grade line up between AA and CB; however, two participants seemed to fail in the Cost Accounting-II with FF grades. One of these two students participated to the observation group while the other to the control group. The failed student in the observation group scored eight of the twelve points given at the pre test and zero points at the post test. The other failed student in the control group scored four of the twelve points given at both pre and post tests.

Averages of pre and post test score evaluations and their differences are given at the Table-3 below, regarding this, average of pre test scores of observation group participants is 7.52 while average of pre test scores of the control group participants is 7.71. There is a 1.16% difference between the pre test scores of observation and control groups. These findings demonstrate that the control group is more successful as for the pre test evaluations.

Table 3: Averages of Pre and Post Test Score Evaluations and Their Differences

	Pre Test	Post Test	Differences
Observation Group	7.57	6.89	0.68
Control Group	7.71	4.71	3.0
Points Difference	0.14	2.18	2.14
% Difference	1.16%	18.16%	17%

When it comes to the post test scores, the difference between the observation and control groups seemed to increase to 18.16%. The observation group achieved an average of 6.89 points at the post test, while the control group had 4.71 points in average. These results displayed a 2.18 points difference between the post test scores of the observation and the control groups.

As of the differences of the pre and post tests' score averages; the control group achieved 7.71 points average at the pre test, and got only 4.71 points in average at the post test with 3.00 points difference where the observation group achieved 7.57 points in average at the pre test and got 6.89 points in average at the post test with 0.68 points difference. In other words, the score averages of the observation group decreased less than that of the control group (0.68<3.00) noting that the concept mapping studies which were executed with the observation group were effective.

Table-4 below shows the percentage differences among the pre and post test scores of the observation group participants. Regarding these results, the post test scores of the twelve of the twenty-eight students in the observation group increased in respect with the pre test scores while post test scores of the eleven students decreased related to their pre test scores. Five students' scores remained the same. The number of the students who increased pre test scores and percentage difference in their pre test scores can be stated as; 8.3% increase in five students, 33.3% increase in four students, and 16.6%, 25% and 66.6% increases in one student, respectively. The number of the students who decreased the pre test scores and the percentage difference in their pre test scores can be stated as; 66.6% decrease in three students, 50% and 16.6% decreases in two students, and 41.6%, 33.3%, 25% and 8.3% decreases in one student, respectively.

Table 4: Observation Group Test Results

Order No.	Participant No.	Pre Test	Post Test	% Change
1	4	4	12	(+) 66.6
2	5	4	8	(+) 33.3
3	8	8	10	(+) 16.6
4	10	8	8	0
5	12	8	8	0
6	15	4	8	(+) 33.3
7	16	8	2	(-) 50
8	18	8	9	(+) 8.3
9	19	8	6	(-) 16.6
10	24	8	2	(-) 50
11	25	8	0	(-) 66.6
12	29	8	6	(-) 16.6
13	30	8	8	0
14	31	8	3	(-) 41.6
15	32	8	9	(+) 8.3
16	34	8	0	(-) 66.6
17	35	8	9	(+) 8.3
18	38	12	9	(-) 25
19	41	12	8	(-) 33.3
20	43	4	7	(+) 25
21	44	8	9	(+) 8.3
22	47	4	8	(+) 33.3
23	49	8	0	(-) 66.6
24	50	8	7	(-) 8.3
25	51	8	9	(+) 8.3
26	53	8	12	(+) 33.3
27	55	8	8	0
28	56	8	8	0

Note:	
Increased	12 students
Decreased	11 students
Unchanged	5 students
TOTAL	28 students

Table-5 below shows the percentage differences among the pre and post test scores of the control group participants. Regarding these results, the post test scores of the four of the twenty-eight students in the control group increased in respect with the pre test scores while the post test scores of the seventeen students decreased related to their pre test scores. Seven students' scores remained the same. The number of the students who increased the pre test scores and the percentage difference in their pre test scores can be stated as; 33.3% increase in three students, and %66.6 increase in one student only. The number of the students who decreased the pre test scores and the percentage difference in their pre test scores can be stated as; 33.3% decrease in ten students, 66.6% decrease in five students, and 100% decrease in two students.

Table 5: Control Group Test Results

Order No.	Participant No.	Pre Test	Post Test	% Change
1	1	4	0	(-) 33.3
2	2	8	0	(-) 66.6
3	3	12	8	(-) 33.3
4	6	8	4	(-) 33.3
5	7	12	8	(-) 33.3
6	9	8	8	0
7	11	12	0	(-) 100
8	13	12	0	(-) 100
9	14	8	4	(-) 33.3
10	17	8	4	(-) 33.3
11	20	8	4	(-) 33.3
12	21	4	4	0
13	22	8	8	0
14	23	8	4	(-) 33.3
15	26	4	12	(+) 66.6
16	27	4	8	(+) 33.3
17	28	4	8	(+) 33.3
18	33	8	8	0
19	36	8	4	(-) 33.3
20	37	8	0	(-) 66.6
21	39	12	4	(-) 66.6
22	40	8	4	(-) 33.3
23	42	12	4	(-) 66.6
24	45	4	4	0
25	46	4	4	0
26	48	4	8	(+) 33.3
27	52	8	8	0
28	54	8	0	(-) 66.6

Note:

Increased	*4 students*
Decreased	*17 students*
Unchanged	*7 students*
TOTAL	*28 students*

In Table-6, a comparison of Cost Accounting-I and Cost Accounting-II grades of the participating students in both the observation and the control group is displayed (See Table 6 in Appendix 1). Twenty-four of the fifty-six participants increased their grades while nine of them decreased in the related courses. The grades of the twenty-three students remained the same.

Thirty-eight out of the fifty-six sample students were female while only eighteen were male, correspondingly in the observation group twenty out of twenty-eight sample students were female where only eight were male. Table-7 below demonstrates the change in the grades with respect to gender. Among the fifty-six participants,

sixteen female and eight male students increased their grades while seven female and two male students decreased theirs. Fifteen female and eight male students' grades remained the same.

Table 7: The Change in Grades with Respect to Gender

Gender	Number of Students Increasing Grade	Number of Students Decreasing Grade	Number of Students Remainig Grade	Total
Male	8	2	8	18
Female	16	7	15	38
Total	24	9	23	56

Table-8 below demonstrates the change in the test results of the observation group with respect to gender. Among the twenty-eight participants, nine female and three male students increased their grades while seven female and four male students decreased theirs. Four female and one male students' grades remained the same.

Table 8: The Change in Test Results of Observation Group with Respect to Gender

Gender	Number of Students Increasing Score	Number of Students Decreasing Score	Number of Students Remainig Score	Total
Male	3	4	1	8
Female	9	7	4	20
Total	12	11	5	28

In respect with the findings above, it is possible to conclude that the observation group achieved cognitive learning through after-class concept mapping studies and that concept mapping is more effective on the participating students' academic achievements than that of the traditional methods. The findings of the research are in accordance with the literature such as Kirkham (2013), Litherland, et al. (2013), Ku, et al.(2014), Chiou (2008) and Ertan, et al. (2014) indicating that using concept mapping method increases students' learning achievements and the level of meaningful learning. The findings of the research also coincide with Simon (2009) noting that concept mapping encourages more student participation in class, and with Simon (2015) showing that concept mapping is useful in making the in-class dialogue more effective and explicit to construct shared understanding between the lecturer and the students. On the contrary, the findings of the research are in contradiction with the literature such as Simon (2007) and Leaby et al. (2010) stating that concept mapping caused no significant differences in students' learning achievements.

5. CONCLUSION

Concept mapping is a technique that helps students perform meaningful learning. Integrity and expressiveness of the knowledge gained through concept mapping make students learn in an ambitious and consistent manner. By avoiding rote learning and determining the relations among the concepts, students can improve their problem solving abilities in such a way to assist them in their professional life and expertise after graduation.

Considering cost accounting practices, all activities from manufacturing to sales are being evaluated and assessed in terms of the cost, expenditure and income. Furthermore, periodic inspections are carried out to reduce the costs and to extract non-profit components from the business process. For the purposes of business management, integrity and expressiveness of the critical information such as cost accounting is expected to be more permanent and rewarding when gained through concept mapping.

In this study, the effects of using concept mapping and the traditional method on the academic achievement of students while learning the fundamental topics of cost accounting were investigated and it was seen that concept mapping had positive effects on students' learning skills. Before starting concept mapping studies with students, a pre-test was applied to determine their achievements in the cost accounting course. It was observed that the success of the students in the experimental group in which the concepts and subjects were

reinforced using concept maps had increased. Therefore, it is possible to conclude that the use of concept maps provided students to learn at cognitive level by integrating the relevant concepts and giving them the ability to analyze the information and knowledge.

This study is reinforcing the affirmative effects of using concept mapping as a method of teaching and learning cost accounting by emphasizing the increase in students' learning achievements and the level of meaningful learning. The authors recommend future studies as to the different and innovative ways and means of incorporating concept mapping in accounting classes may contribute to the literature.

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APPENDIX 1: Working Group Schedule and Tables

Weekly Concept Mapping Working Group Schedule	
Week 1	Introduction: Explanation of concept mapping and research methodology, topic assignment
Week 2	First presentations: Groups A and B
Week 3	First presentations: Groups C and D
Week 4	First presentations: Altering and adjusting
Week 5	Second presentations: Groups A and B
Week 6	Second presentations: Groups C and D
Week 7	Second presentations: Altering and adjusting
Week 8	Third presentations: Groups A and B
Week 9	Third presentations: Groups C and D
Week 10	Third presentations: Altering and adjusting
Week 11	Fourth presentations: Groups A and B
Week 12	Fourth presentations: Groups C and D
Week 13	Fourth presentations: Altering and adjusting
Week 14	Final week: Overall assessment, evaluation and conclusion

Table 2: Research Data Set

Order No.	Pre Test	Post Test		Grade of Cost Accounting I	Grade of Cost Accounting II	GPA
		Observation Group	Control Group			
1	4		0	BB	CB	2.29
2	8		0	CB	BA	2.62
3	12		8	CB	CC	2.00
4	4	12		CB	BA	2.74
5	4	8		CB	CB	2.22
6	8		4	BA	BA	2.50
7	12		8	BA	BA	3.09
8	8	10		AA	AA	3.04
9	8		8	CB	CC	2.45
10	8	8		CB	BB	2.50
11	12		0	BA	BA	3.34
12	8	8		AA	BA	3.52
13	12		0	AA	AA	3.47
14	8		4	AA	BA	3.00
15	4	8		BA	BA	2.33
16	8	2		AA	AA	3.57
17	8		4	CB	BB	2.72
18	8	9		BB	BA	2.50
19	8	6		CB	AA	2.33
20	8		4	BB	BB	2.24
21	4		4	BB	FF	2.31
22	8		8	AA	BA	3.01
23	8		4	CB	CB	2.60
24	8	2		BB	BA	2.79
25	8	0		BB	FF	2.01
26	4		12	CB	BB	2.50
27	4		8	BB	BA	3.33
28	4		8	CB	AA	3.10
29	8	6		CB	BB	2.59
30	8	8		BB	BA	2.37
31	8	3		AA	AA	3.38
32	8	9		BB	BB	2.50
33	8		8	CB	CB	2.38
34	8	0		CB	BA	3.25
35	8	9		CB	BA	3.22
36	8		4	BB	BB	2.37
37	8		0	BB	BA	2.11
38	12	9		AA	AA	3.62
39	12		4	BB	BB	3.00
40	8		4	BB	BB	3.02
41	12	8		CB	AA	2.00
42	12		4	BB	BB	2.75

Table 2: Research Data Set

Order No.	Pre Test	Post Test		Grade of Cost Accounting I	Grade of Cost Accounting II	GPA
		Observation Group	Control Group			
43	4	7		CB	BB	2.55
44	8	9		CB	CB	2.44
45	4		4	CB	BA	2.96
46	4		4	CB	BA	2.34
47	4	8		BB	BB	2.36
48	4		8	BB	BA	2.10
49	8	0		AA	BA	2.74
50	8	7		BB	BA	2.83
51	8	9		CB	BA	3.13
52	8		8	AA	AA	3.43
53	8	12		BB	BA	3.00
54	8		0	BA	BA	2.66
55	8	8		CB	CB	2.03
56	8	8		CB	BA	3.06

Note: Letter grades in the table are equivalent of numerical grades on 4.0 scale as mentioned below:
AA = 4.0
BA = 3.5
BB = 3.0
CB = 2.5
CC = 2.0

Table 6: Direction of Change in Grades of Observation and Control Groups

Order No.	Grade of Cost Accounting I	Grade of Cost Accounting II	Direction of Change in Grade
1	BB	CB	↓
2	CB	BA	↑
3	CB	CC	↓
4	CB	BA	↑
5	CB	CB	↔
6	BA	BA	↔
7	BA	BA	↔
8	AA	AA	↔
9	CB	CC	↓
10	CB	BB	↑
11	BA	BA	↔
12	AA	BA	↓
13	AA	AA	↔
14	AA	BA	↓
15	BA	BA	↔
16	AA	AA	↔
17	CB	BB	↑
18	BB	BA	↑
19	CB	AA	↑
20	BB	BB	↔
21	BB	FF	↓
22	AA	BA	↓
23	CB	CB	↔
24	BB	BA	↑
25	BB	FF	↓
26	CB	BB	↑
27	BB	BA	↑
28	CB	AA	↑
29	CB	BB	↑
30	BB	BA	↑
31	AA	AA	↔
32	BB	BB	↔
33	CB	CB	↔
34	CB	BA	↑
35	CB	BA	↑
36	BB	BB	↔
37	BB	BA	↑
38	AA	AA	↔
39	BB	BB	↔
40	BB	BB	↔
41	CB	AA	↑
42	BB	BB	↔
43	CB	BB	↑
44	CB	CB	↔
45	CB	BA	↑
46	CB	BA	↑

Table 6: Direction of Change in Grades of Observation and Control Groups

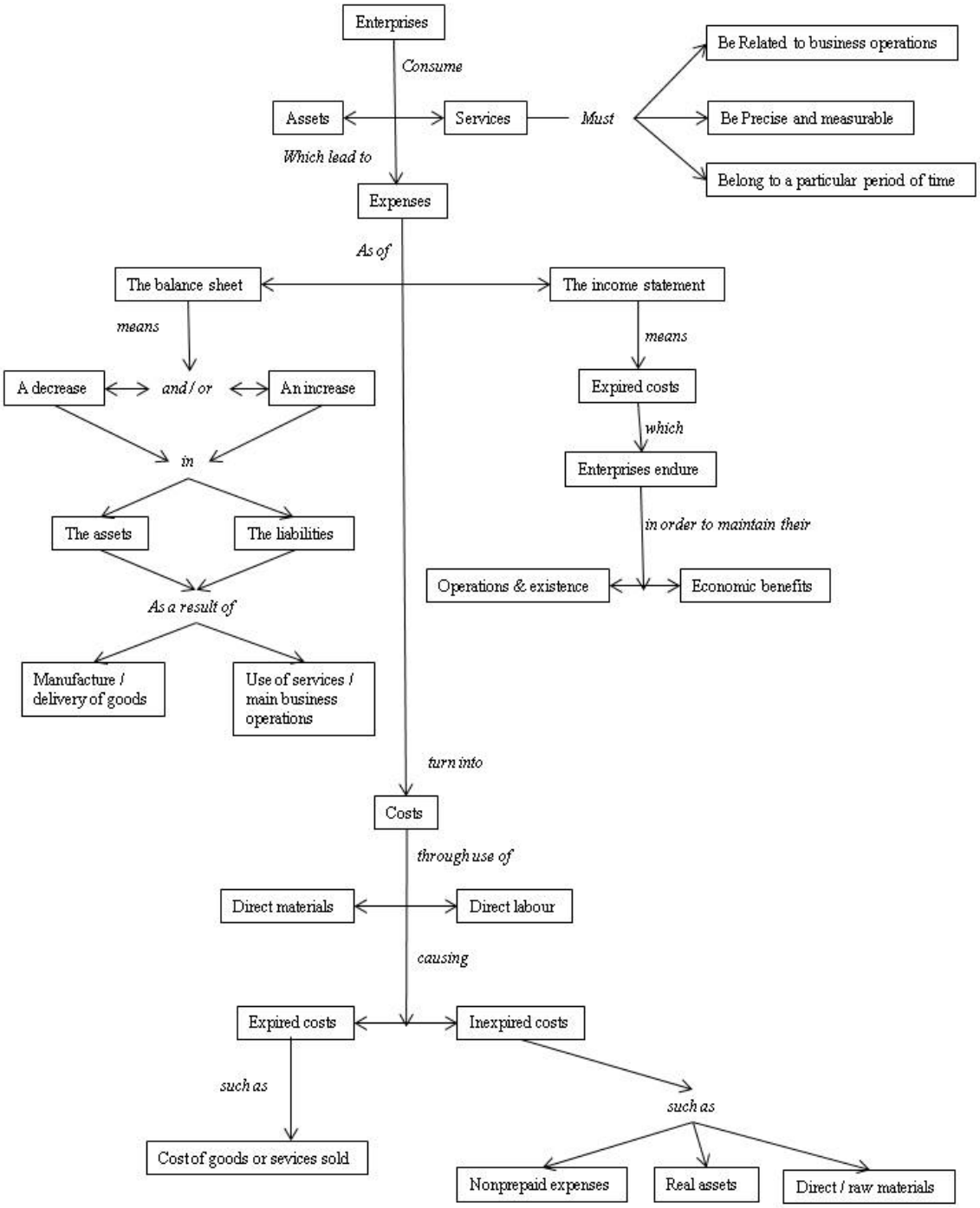
Order No.	Grade of Cost Accounting I	Grade of Cost Accounting II	Direction of Change in Grade
47	BB	BB	↔
48	BB	BA	↑
49	AA	BA	↓
50	BB	BA	↑
51	CB	BA	↑
52	AA	AA	↔
53	BB	BA	↑
54	BA	BA	↔
55	CB	CB	↔
56	CB	BA	↑

Note:

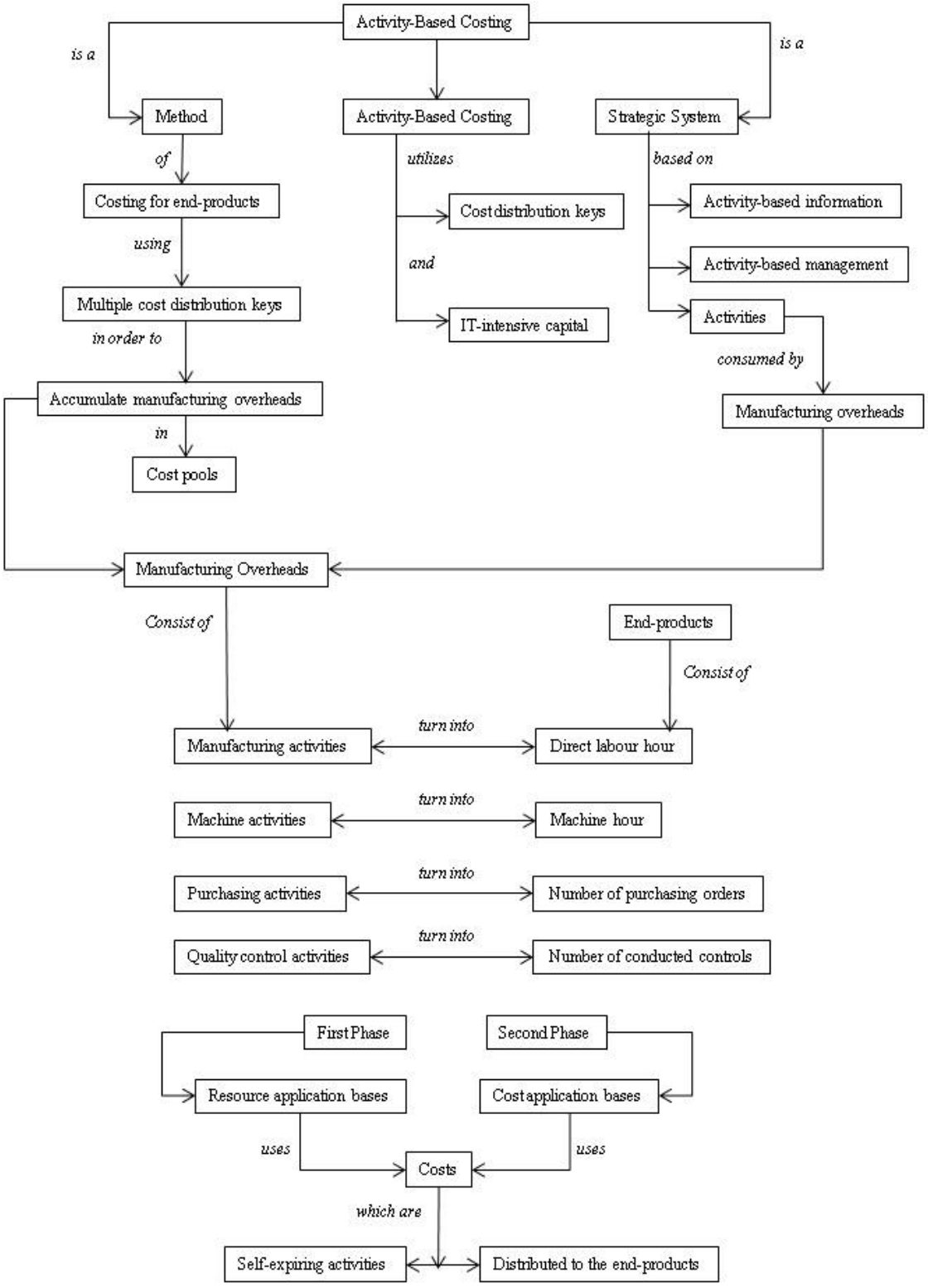
Increased ↑	*24 students*
Decreased ↓	*9 students*
Unchanged ↔	*23 students*
TOTAL	*56 students*

APPENDIX 2. Examples of the Concept Maps Prepared by Observation Group Participants

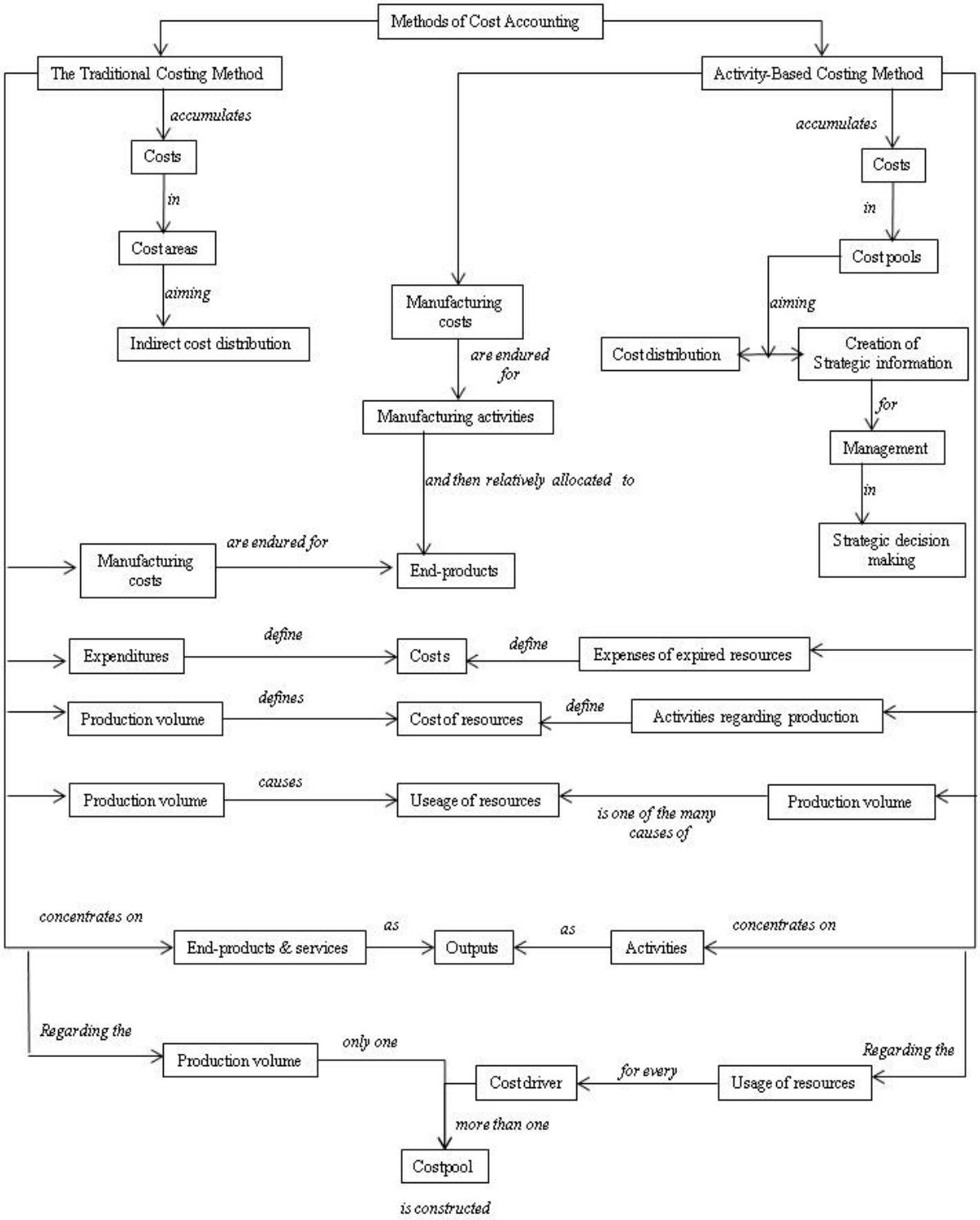
First Presentations:



Second Presentations:



Third Presentations:



Fourth Presentations: