RETHINKING THE USE OF CONCEPT MAPS IN INTRODUCTORY ECONOMICS COURSES

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ABSTRACT

A Conceptual Chapter Map is a modified version of a traditional concept map, which in addition to illustrating the links among concepts, also provides explanations of concepts, which makes it a more practical learning tool since students can use it not only to understand the concepts, but also while studying or working on problem sets. This paper discusses the benefits of Conceptual Chapter Maps as compared to traditional concept maps and lecture notes, discusses why instructors of economics courses should consider conceptual chapter maps as a valuable learning tool, provides practical strategies for creating and delivering conceptual chapter maps, and reports students' attitudes toward the use of these maps in introductory economic courses.

INTRODUCTION

Concept maps are widely used in various educational disciplines to help students develop an understanding of a subject matter. Traditional concept maps show how concepts are related to each other by illustrating the links among multiple concepts. This paper will introduce a modified version of the traditional concept map, which I refer to as a Conceptual Chapter Map. The Conceptual Chapter Map not only shows the links among concepts, but also provides an explanation of each, thereby creating a more efficient learning process.

The idea of graphical concept organization was first proposed by David Ausebel in 1960, and further developed by Joseph Novak in the 1970s. Novak's version of concept organization is what educators now consider a traditional concept map: a tree diagram that shows the links among concepts. Research shows that concept maps significantly improve student learning and allow students to retain newly-obtained information more efficiently when compared to traditional lectures (Horton et al., 1993; Willerman and Macharg 1991). Traditional concept maps make the learning process easier and help students separate the most important information from what is not essential (Ellis, 2001). Concept maps are also used by instructors to promote successful collaborative learning in- and outside the classroom (Budd 2004; Baitz 2009).

Concept maps are widely used in various disciplines such as mathematics, physics, biology, and chemistry (Chiou 2008), but are seldom used in economics. By my personal observations, economics instructors are reluctant to use concept maps. This is unfortunate since this teaching tool can help students who are new to economics unravel the complexities of economic concepts.

In introductory economics courses, students develop a fundamental understanding of basic economic principles. It is during these classes that students learn economics "from scratch." Some may become overwhelmed with the amount of new information presented in class, for most topics students have several pages of notes, and it may be difficult for them to see how different concepts are related to each other. Traditional concept maps can help students organize their knowledge by creating a visual representation of how the concepts are linked, and

have shown to improve student learning (Jacobs-Lawson & Hershey 2002, Novak & Cañas 2008). Traditional concept maps are most helpful in developing the understanding of links between the concepts. However, on their own, these maps are not sufficient in helping students solve problems, since students have to refer to a text book or lecture notes to find explanations of the concepts being studied. Traditional lectures, on the other hand, provide students with definitions, explanations, and examples, but fail to show how concepts are related to one another. Traditional lectures and traditional concept maps complement each other, but are not very practical when used separately.

Research suggests that students learn better and with less difficulty when all the information they need is provided within a single source (Mayer 2009). The Conceptual Chapter Map as proposed in this paper follows the idea that a single information source benefits student learning. It combines the elements of traditional lecture notes with traditional concept maps, thereby providing students with a simple, visual, and easy-to-follow learning tool.

For example, while a traditional concept map may illustrate that Gross Domestic Product can be either real or nominal, a Conceptual Chapter Map takes this one step further and illustrates, using formulas, that Real GDP is calculated using base-year prices and Nominal GDP is calculated using current prices. The Conceptual Chapter Map shows student not only that there are several ways of calculating GDP, and explains the differences among these approaches. The following figures illustrate the differences between a Conceptual Chapter Map and a traditional concept map, both explaining concepts related to Gross Domestic Product. Figure 1 shows a traditional concept map, adopted from Johnston, Carol, University of Melbourne, and Figure 2 shows a Conceptual Chapter Map which I have used while teaching a Principles of Macroeconomics course during the Spring 2012 semester at the University of Central Oklahoma.

While both maps are relatively similar in the way they structure and illustrate the concepts, there are more explanations included in the Conceptual Chapter Map than in the traditional concept map, thus allowing students to answer most questions related to the GDP topic.

Figure 1. GDP: Traditional Concept Map

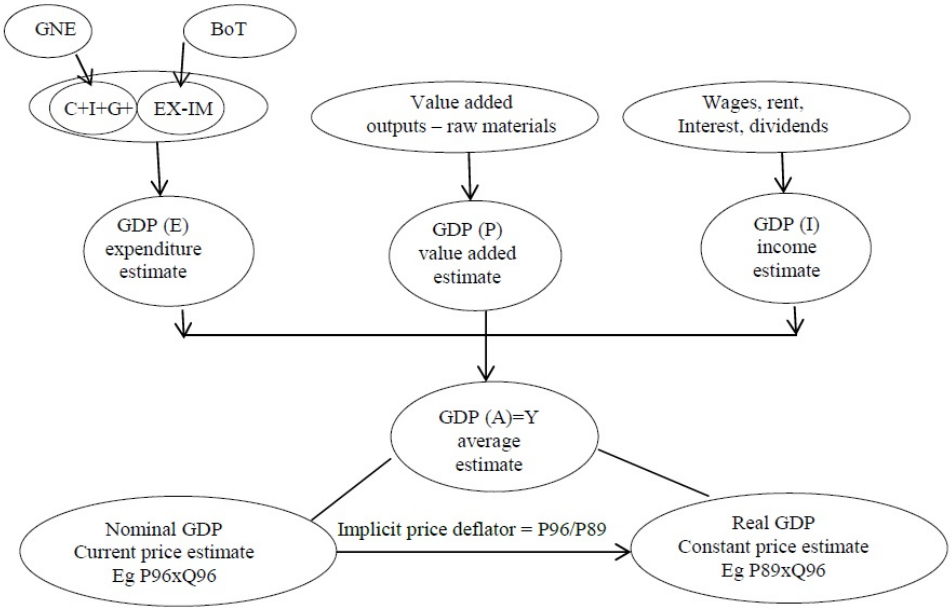
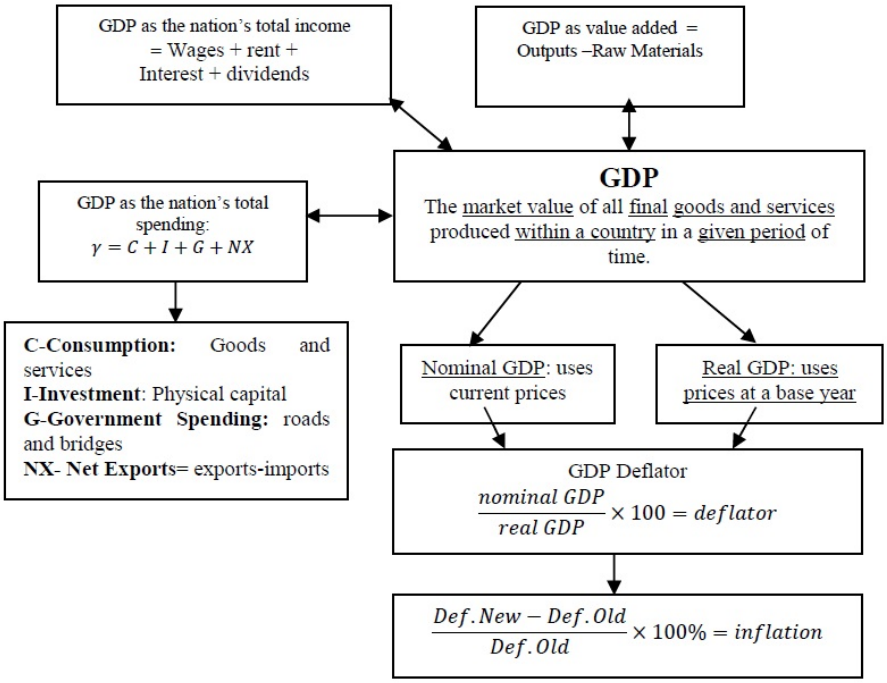


Figure 2. GDP: Conceptual Chapter Map



Figures 3 and 4 illustrate the differences between a conceptual chapter map and a traditional concept map for the concept of supply curve. Figure 3 shows a traditional concept map, adopted from Marangos and Alley (2007) and Figure 4 shows a Conceptual Chapter Map which I have used while teaching a Principles of Microeconomics course during the Spring 2013 semester at the University of Central Oklahoma.

Figure 3. Supply Curve: Traditional Concept Map

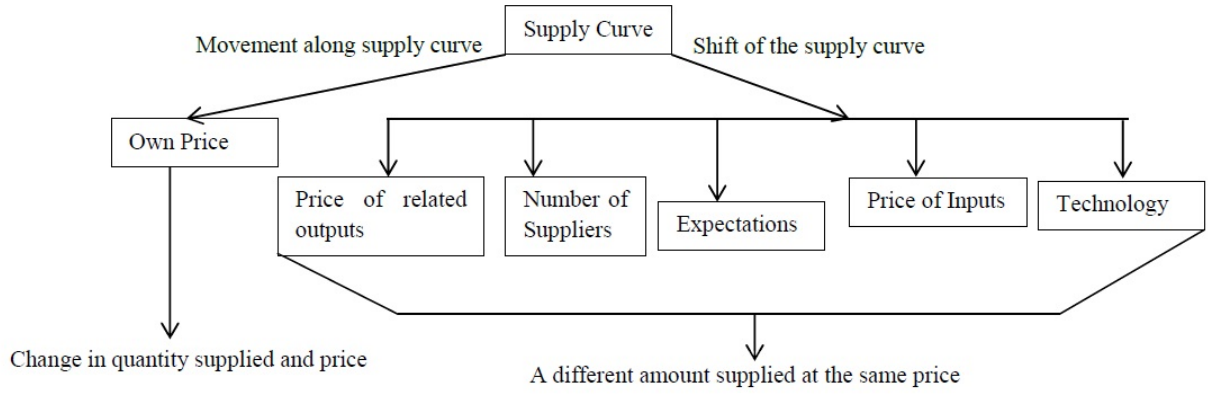


Figure 4. Supply Curve: Conceptual Chapter Map

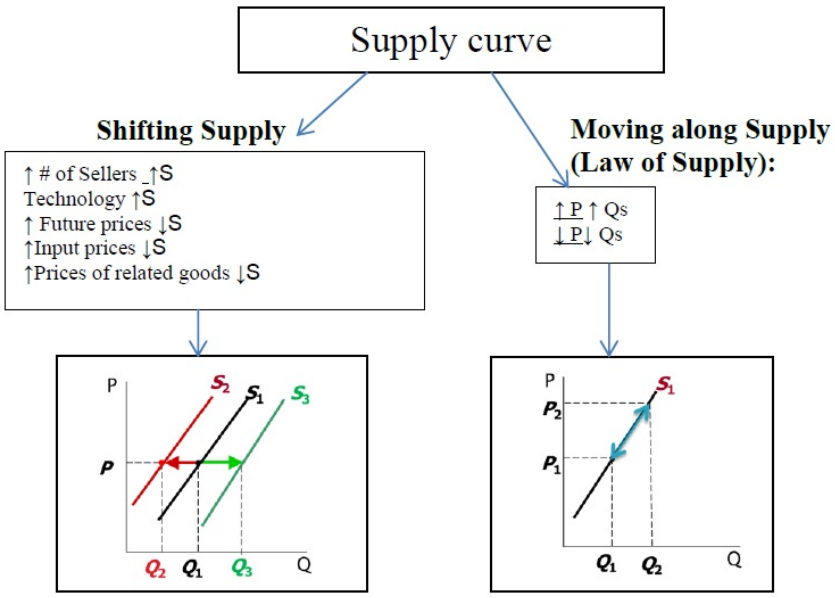


Figure 3 and figure 4 illustrate the same links among concepts related to supply curve. Both maps show that there is a difference between shifting supply curve and a movement along supply curve, and both indicate what causes these changes. In addition, the Conceptual Chapter Map also illustrates these changes using graphs, while the traditional concept map does not.

PRACTICAL STRATEGIES FOR CREATING AND DELIVERING CONCEPTUAL CHAPTER MAPS

While working with students in introductory economics courses, I have noticed certain patterns in students' inability to differentiate between concepts. While a visual learning tool such as a traditional concept map allows students to see the differences between concepts, it does not provide the context necessary to explain those differences. For example, a traditional concept map may illustrate that Price Elasticity of Demand is different from Income Elasticity, but it does not explain the underlying differences between those two concepts. Adding another layer of explanation provides students with contextual information they can use as a building block to develop further understanding of the concepts being introduced. The Conceptual Chapter Map was developed as a means to improve upon a traditional concept map by adding the missing contextual information to existing visual cues.

Starting in the fall of 2011 I have been using Conceptual Chapter Maps in Principles of Microeconomics and Principles of Macroeconomics courses. I would use the Conceptual Chapter Maps to conduct a review before in-class assignments, or I would ask students to create maps either in groups during the class or on their own after the class.

Research evaluating the effectiveness of teacher- vs. student-created maps has shown mixed results. Some studies show that students receive greater benefits by creating their own concept maps (Novak 1990). Others find that concept maps benefit students regardless of

whether the map is created by a student or instructor (Armbruster, Anderson, & Meyer 1991; Doyle 1999; Ellis 2001).

Instructors may also chose to assign students with the creation of concept maps in order to actively engage students in the learning process. When students create concept maps in groups they participate in collaborative learning, which has shown to have a positive effect on learning outcomes (Budd 2004; Baitz 2009). Student-created concept maps can also be used as a tool to evaluate students' understanding of a topic or a concept (Ruiz-Primo, Schultz, Li, & Shavelson 2001; Markham, Mintzes, & Jones 1994).

While the benefits are notable, there may also be downsides to student-created maps. First, most students are unfamiliar with the idea of concept mapping. Therefore, instructors need to spend time training students on how to develop a concept map. In fact, studies have shown that explicit training in the creation of concept maps is an important factor in its effective use (Lenz, Alley, & Schumaker 1987; McCagg 1991). This can be a time-consuming exercise and given the limited nature of class time, may not always be practical.

Second, students can resist learning how to create and use concept maps. From my personal experience, unless students receive a grade for creating a concept map, many may completely disregard the assignment. In their 2007 study, John Marangos and Sean Alley assigned students to create concept maps in a Principles of Microeconomics course. Study results revealed that students did not highly value the concept maps, and the majority of students completed the assignment only for the grade received. Most students stated they would likely not use this tool in the future.

Finally, students may misunderstand concepts or links among the concepts since the information presented in introductory economics classes is new for most. As a result, this may create an undesirable situation in which students visualize connections among concepts that may be wrong. Instructors can follow students' work during the assignment and try to correct these misperceptions in class, but given the limited nature of class time, this may not be feasible. Instructors can also collect student-created maps in order to make necessary corrections, but there is no guarantee that students will learn from these corrections.

Instead of making students responsible for creating a Conceptual Chapter Map, instructors can use a mixed approach that involves creating a map in class with the help of students. In order to avoid misunderstanding concepts and their connections, the instructor can create the "skeleton" of the map, and students can help fill it in with the definitions and explanations of concepts. For example, an instructor will show the difference between a shift in the supply curve and the movement along the curve, and students will have to answer which factors are causing which of the changes. This exercise creates a dialog between students and the instructor, and involves students in the process of map creation.

In my classes I have noticed that students trust instructor-created maps much more than they trust the maps created either on their own or in groups. When the maps are presented to students as a review before in-class assignments, students actually use them while working on the assignment. The ability of students to use a Conceptual Chapter Map while studying or working on an in-class assignment is one of its main benefits compared to traditional concept maps or traditional lecture notes.

From observing classroom behavior, instructors may notice that students are not relying on their notes when answering questions or when assigned to work on practice problems. Notes usually contain too much information and are thus difficult to use when trying to find answers. On the other hand, traditional concept maps may not have all of the explanations to make it

possible to answer the questions. Conceptual Chapter Maps are more practical since they combine the visual construct of a traditional concept map with the concept explanations found in the lecture notes.

Regardless of the method used, there will always be students who chose not to look for the answers among the tools provided, but instead rely upon their own, often incorrect, understanding of the subject. When answering questions from these students, the instructor can rely on the Conceptual Chapter Map to show students how the answer can be found or confirmed.

Since Conceptual Chapter Maps combine elements of both traditional concept maps and traditional lectures, instructors must be wary of providing information that is superfluous to understanding the basic concepts. Research shows that people learn better when extraneous material is excluded rather than included (Mayer 2009). Traditional lecture notes often have multiple definitions, examples and explanations, but not all of these are critical to understanding the concepts being taught. This creates an overload of information for the student, who is unable to discern what is and isn't most important. A Conceptual Chapter Map should be constructed in such a way that they are easily readable and contain only information essential for students to learn.

In this regard, the creation of a Conceptual Chapter Map is a useful exercise for the instructor. It helps to reorganize the material in a more meaningful way, and can improve lecture delivery by allowing the instructors to evaluate which points are most important and should be emphasized. Additionally, when compared to a traditional concept map, a Conceptual Chapter Map forces the instructor to rethink and reevaluate how to explain concepts during the lecture.

STUDENT ATTITUDES TOWARDS THE CONCEPTUAL CHAPTER MAPS

During the Spring 2013 semester, students in Principles of Microeconomics classes at the University of Central Oklahoma were introduced to Conceptual Chapter Maps. At the beginning of the class in which students would work on the in-class assignments, I would draw a Conceptual Chapter Map on the board and would encourage students to refer to the map while working on the assignment. My role was to ensure that the most important concepts were included in the map, and that the map illustrated the correct links among those concepts. Students also participated in map creation by finding concept definitions, explanations, and illustrations. I helped rewrite these explanations in a shortened form. For example, students would say that Supply increases when more sellers enter the market and I would rewrite this statement as "↑# sellers →↑S." Rewriting concept explanations in a simplified form assured that the maps would not be overcrowded with information. If during the in-class assignment students had any questions, I would answer them by referring directly to the conceptual chapter map.

At the end of the semester, students were asked to complete a survey revealing their attitudes toward the conceptual chapter maps. The surveys were administered during the last class of the semester and submitted by students anonymously. Of a total 65 students comprising both Principles of Microeconomics courses, 51 students completed the survey. Of those, 46% were freshman, 40% were sophomores, and 14% were either juniors or seniors. The average GPA indicated by students was 3.02, and the average grade the students expected to receive in class was 2.92.

Most of the survey questions were true/false questions. Since students had access to both traditional lecture notes and conceptual chapter maps, they were asked to specify which tool they

preferred to use while studying. Students were also asked to examine the concept maps they received throughout the semester and specify which chapter maps they found to be most useful and least useful. The survey questions are presented in the Appendix C. The results of the Survey are presented in Table 1.

Table 1
Students' Attitudes Towards Conceptual Chapter Maps

	% answered True
Conceptual Chapter Maps were helpful	96
Conceptual Chapter Maps were easy to use	90
Conceptual Chapter Maps helped me learn	94
I have used Conceptual Chapter Maps while working on Homework	70
I have used Conceptual Chapter Maps while working on in-class assignment	72
I have used Conceptual Chapter Maps while studying for midterm	94
I have used Conceptual Chapter Maps while studying for a quiz	70
I will use Conceptual Chapter Maps to study for the Final	92

Overall, the survey results indicated that students had a positive regard for the conceptual chapter maps. Questions 1-3 investigated whether the conceptual chapter maps were considered to be a useful studying tool by students. Survey results showed that 94% of students agreed that the concept maps helped them learn. Ninety-six percent of students indicated that conceptual chapter maps were helpful, and 90% of students indicated that the conceptual chapter map was easy to use.

Of the results reported, 71% of students stated they used concept maps while working on in-class assignments, during a homework assignment, or while studying for a quiz. The vast majority of students (94%) stated that they used the conceptual chapter map while studying for the midterm, and 92 % of students stated that they would use the map to study for the final exam. Marangos and Alley (2007) asked their students similar questions, but the results were not as favorable toward the traditional concept maps used in their classroom. They found that on average, 43% of students used concept maps to study for midterm and 62% of students indicated they would use concept maps in their final exam preparation.

The University of Central Oklahoma students surveyed were also asked whether they preferred to use conceptual chapter maps or lecture notes while studying. Of all students reporting, 45% stated that they prefer conceptual chapter maps to the lecture notes, 20% prefer traditional lecture notes, and 35% preferred to use both. This result indicates that conceptual chapter maps are not a perfect substitute for the lecture notes, but rather an additional tool students can refer to while studying.

Table 2
The Most and the Least Useful Conceptual Chapter Maps

	Most Useful (# of mentions)	Least useful (# of mentions)
Production Possibility Frontier	0	10
Supply and Demand	25	5
Elasticity	25	6
Government controls	24	3
Welfare economics and its application	32	4
Costs	23	2
Market structure	17	0

The results from table 2 are somewhat surprising but also informative. No students found the conceptual chapter map for Production Possibility Frontier to be most useful, but 20% found it to be the least useful. This may indicate that in the beginning of the semester, when students were first being introduced to conceptual chapter maps, they did not fully understand or appreciate the benefits of this tool. The other possible explanation is that the concepts related to PPF were not as widely used throughout the semester as Supply and Demand concepts. Finally, students may not have had difficulties understanding these concepts, thus explaining why they regarded this particular Conceptual Chapter map as the least useful. Other maps were somewhat similar in their usefulness, with most students indicating their usefulness rather than the opposite. While it is noticeable that different students regard different conceptual chapter maps as being more useful than others, the overall results demonstrate that if the time allows, it's better to provide students with a chapter map regardless of its perceived usefulness than not.

Students were also asked to provide comments regarding usefulness of concept maps. Appendix B provides the list of all comments received from students. Interestingly enough, even though the benefits of the conceptual chapter maps were never discussed in the classroom, many students in their comments pointed out the benefits of conceptual chapter maps similar to those as described in the paper. To summarize, the following benefits of the conceptual chapter maps were mentioned the most by the students:

Summarized main idea of each chapter
Showed links among concepts
Good for visual learners
Good study tool, easy and convenient
Good way to review material
Provided explanations, equations, and graphs
Concise summary of each chapter, one page instead of several pages of notes

There are several questions that require further investigation. First, students in my classes were only comparing conceptual chapter maps with traditional lecture notes. In the future, it would be interesting to investigate student attitudes towards conceptual chapter maps in relation to traditional concept maps. Also, the existing literature provides extensive reports on the effectiveness of traditional concept maps, but further investigation is needed to evaluate the effectiveness of the conceptual chapter maps in student learning outcomes.

CONCLUSIONS AND DISCUSSION

The goal of this paper was to introduce a practical teaching and learning tool which combines both the elements of traditional concept maps and lecture notes by illustrating the links among concepts and providing explanations of those concepts. Pulling from the idea of traditional concept maps, Conceptual Chapter Maps allow students to learn about conceptual relationships while concurrently utilizing definitions and explanations from lecture notes used while working on practical assignments or studying for exams.

Conceptual Chapter Maps can be delivered to students in the form of a topic review prior to a practical assignment. With conceptual Chapter Maps, students receive a condensed version of lecture notes, which helps them to review covered material and also allows them to organize and structure newly-obtained knowledge in a simple, visual way. Additionally, the Conceptual Chapter Map contains all the covered material on a single page so students do not need to flip through several pages of notes in order to find the necessary information to answer questions.

Creating Conceptual Chapter Maps is also a useful exercise for instructors, as it allows them to reorganize the material, evaluate which points are most important and should be emphasized, thereby improving upon lecture delivery.

The students studying Principles of Microeconomics at the University of Central Oklahoma during Spring 2013 semester responded extremely positively to the use of conceptual chapter maps as a learning tool. Perhaps visual learners benefited the most from using conceptual chapter maps, as students specifically noted that these maps helped them visualize learned material. In addition, most of the students stated they used conceptual chapter maps while studying for both midterm and final exams. Even those who said they preferred to use lecture notes for studying would still refer to conceptual chapter maps to clarify information. Based on students' comments, it can be stated that most students believe the conceptual chapter maps helped them learn. Whether conceptual chapter maps actually improve learning outcomes is yet to be determined.

APPENDIX A. QUESTIONER

This questioner is designed to identify the benefits of conceptual chapter maps in the class you are taking. To participate in this study, please fill out the questionnaire and return in to survey administrator. Your involvement is completely voluntary and your decision to participate or not participate will not influence your grade in this class. All information gathered for this study will be anonymous. This means that there is no identifying information linking you to the survey that you fill out.

GPA
Year in college
Time spent studying per week for this class
Expected grade in this class

Concept maps were helpful in general		Yes	No
Concept maps were easy to use		Yes	No
I used concept maps while			
Doing homework		Yes	No
Studying for a quiz		Yes	No
Studying for a midterm		Yes	No
Working on in-class assignment		Yes	No
Concept maps helped me learn		Yes	No
While studying, I prefer to use:	Maps	Lecture notes	Both

Please review concept maps and answer the following questions:

List numbers of chapters for which concept maps were the most useful

List number of chapters for which concept maps were the least useful

Please comment on usefulness of chapter maps in Principles of Microeconomics class:

APPENDIX B.
STUDENTS' COMMENTS REGARDING CONCEPTUAL CHAPTER MAPS

It was most helpful to my understanding of differences among graphs
The concept maps were very useful because they were the main idea of lecture so you hit the main points and put them in one paper
I liked using them, especially when preparing for midterm/final
They were helpful for review before tests and to make the note cards
I think they help you overall since they are easy to use and convenient
Made everything so much more clear. Making them was a way to recap everything and study!
The chapter maps helped me understand the material better, as well as helped me study for the midterm
I feel like if I just look at the maps I get confused. They were a great asset only after I had understood the material. For me they were a little overwhelming. They were still helpful.
The chapter maps have useful data + information but it is hard to interpret some in user friendly terms.
Lecture notes along with maps were all useful
Very useful, clear summary of a chapter
After learning and reading the material I used maps to review. Very useful to review before a quiz or a test
Maps took all the lecture information and condensed it into one map that helped show connections
They were clear and made studying easier
Breaks things down, makes them easier to understand
They were useful because I am very visual learner and the pictures made it easier for me to understand
They were all very useful and summarized the material into quick study tools
I feel like when I would use them during HW or studying, when I took the test I could picture the maps and better remember the material
They were useful, I just prefer lecture notes. But I would refer to chapter maps when get confused in notes.
Some were helpful but others were jumbled and didn't help that much. The ones that were helpful I really liked
They are very useful for studying for the tests in this class
Very useful and easy to comprehend. Helped when doing in-class assignments and homework
Extremely useful, especially having the equations needed and graphs, the directions.
They shortened the time of reviewing
Help to summarize the chapters
They helped me studying and figure out the chapters
They were a great help!
Good for visual learners
I wish we had more, and had blank ones on the test. My handwriting is bad, so having them posted online helped me to see what I failed to draw. Continue using the maps.
I like using lecture notes since they are more in depth and have graphs. Many times I used the maps but still had to use notes.
Visualized the information
They did help but some are more confusing than helpful
Maps come handy as quick references, in particular when solving problems
They gave overall vision of what to learn
At times I confused myself with a map but all in all I enjoyed having them. Would recommend hanging them out sooner
I am a visual learner so the maps really helped me to learn the material
The concept map helped me to understand the material a lot more than reading through my notes
It made it easier for me than when I used the lecture notes, clear and useful
I used the maps while studying but I feel like chapter 4 wasn't very helpful

I enjoyed the maps. They were concise summaries of each chapter and made studying easier and more efficient

All of the maps were useful. It makes it easier to read when the notes are visually broken down in graphs

All of the maps were very useful to me

It is very convenient and the basics of a chapter can be found on one piece of paper

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