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THE EFFECTIVENESS OF CONCEPT MAPS IN INTRODUCTORY MICROECONOMICS

by

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1 Introduction

If one was to ask a first year Microeconomics student to explain the process of equilibrium, it is highly likely that their response would consist of a demand and supply diagram and a written explanation that would look something like the following, quantity demanded > quantity supplied → ↑P → ↓QD, ↑QS → QD=QS. Demand and supply diagrams and the casual relationships that often accompany such diagrams are prominent teaching tools for first year Microeconomics. Yet it is somewhat puzzling that concept maps, which can incorporate all of the above information, have not been so readily introduced into economics. A concept map is a special form of a web diagram for exploring knowledge and gathering and sharing information. Concept mapping is the strategy employed to develop a concept map. A concept map consists of nodes or cells that contain a concept, item or question and links. The links are labelled and denote direction with an arrow symbol. The labelled links explain the relationship between the nodes. The arrow describes the direction of the relationship and reads like a sentence (http://www.graphic.org/concept.html).

Concept mapping has distinct advantages over traditional teaching methods. Concept mapping facilitates meaningful learning and as a result higher scores have been recorded in student tests (Novak, Gowin and Johansen 1983; Fraser and Edwards 1985). This though is not the only advantage of concept mapping. Concept maps preform a social function, that is, the construction of a concept map naturally brings people together (Roth and Roychoudhury, 1992; Marangos, 2000). The literature regarding the use of concept mapping for educational purposes has generally been positive. Unfortunately though, the majority of this research has been restricted to introducing the role of concept maps in science teaching. There is a large void in the available research concerning the development of concept maps for economics. The purpose of this paper is to help fill this void by examining the impact of concept mapping on first year Micro-economics students in achieving positive learning outcomes, within the context of collaborative problem based tutorials.

In the following, two examples of concept mapping are provided. The first concept map links the factors that influence the demand curve, while the concept map links the concepts associated with the Production Possibilities Frontier.

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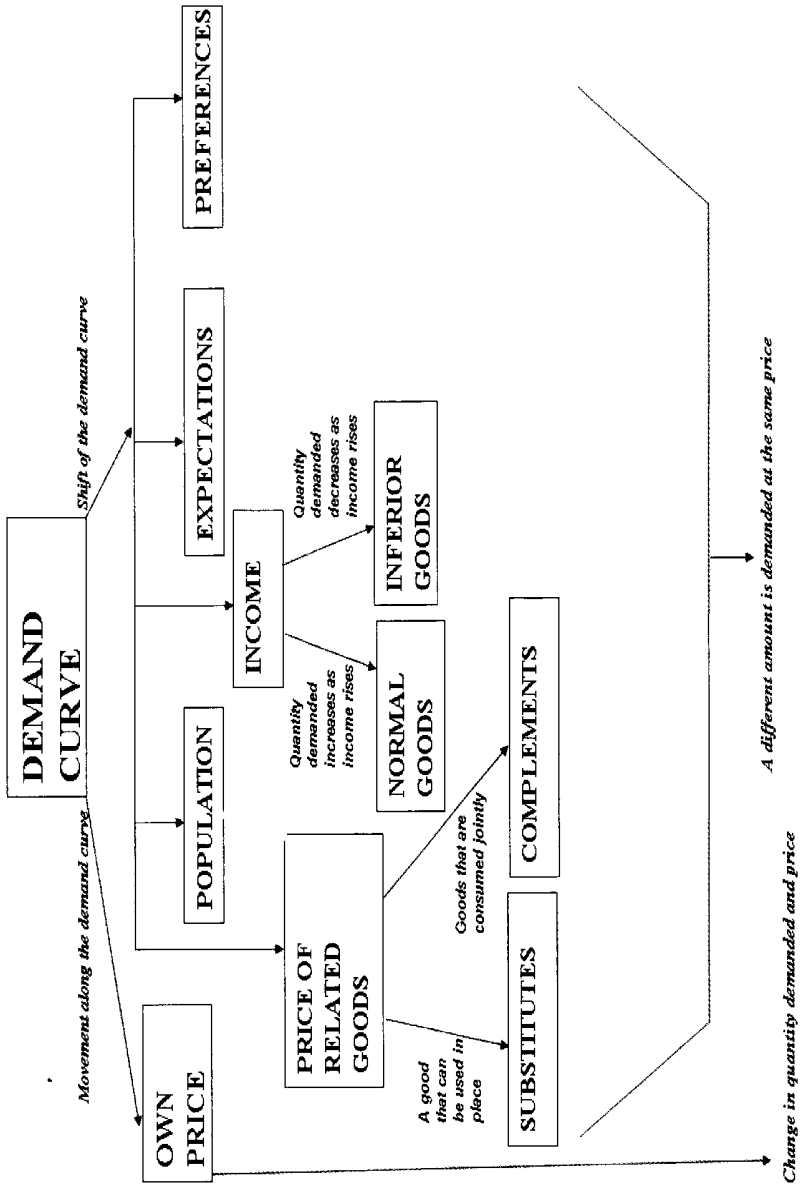

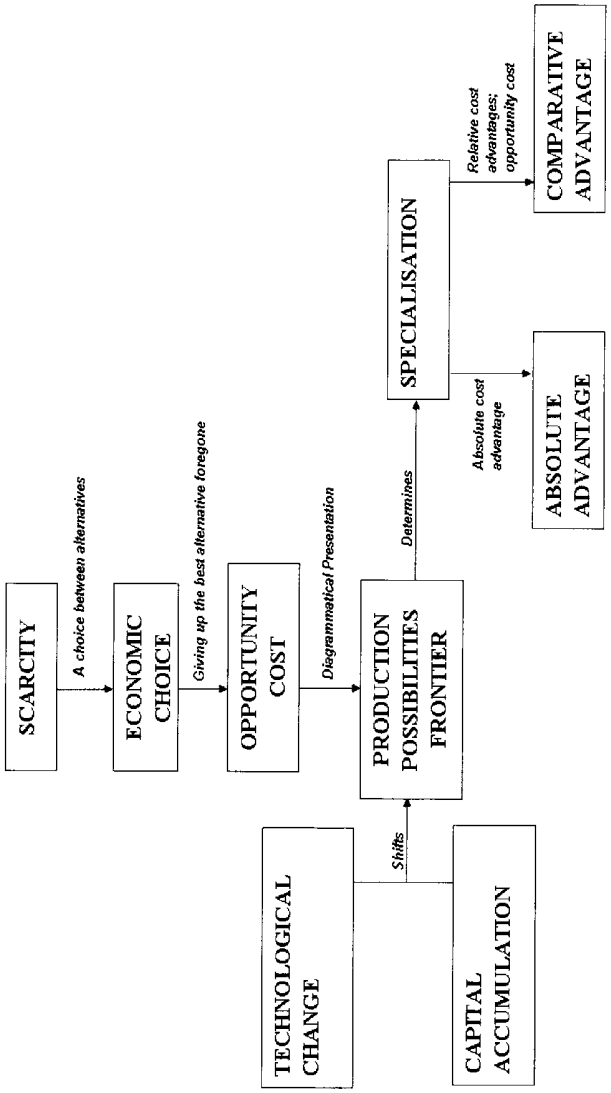

2 Literature Review

The standard approach to teaching first year Microeconomics at the university level has been composed of two one-hour lectures and a one-hour tutorial session. This approach though has been under increasing scrutiny. Lee *et al* (1996) have indicated that lecturers wished to introduce a range of reforms to the organisation and teaching of first year economics. Furthermore, the traditional approach to teaching economics has resulted in a stagnation of positive learning outcomes and achievements (Marangos, 2000). Evidence of this has come from Dundas (1993), who found that students were passive participants in both the lecture and more importantly, the tutorial sessions. Dundas (1993) revealed that in tutorials students passively copied down notes and answers with limited interaction and also without verbal comprehension as to how the contents of the course could be applied to real world scenarios. This finding is alarming as tutorials are designed to be a time for active student participation. Furthermore, Bartlett (1995) found that students were only interested in getting the right answer and not why the question was important. These results have indicated that economics students are not engaged in deep learning.

Marton *et al* (1976) introduced the distinction between deep and surface learning. Deep learning or deep level processing directs the student towards the intentional content of the learning material, in other words, to find the significance of any given problem. With surface learning, the student searches for the obvious answer within the text and not the underlying significance to the learner. Thus, the surface learners tend to use a "rote learning" strategy, triggered as a medium to achieve a short term goal (Marton and Saljo, 1976). Whilst students who use this approach may be successful in memorising entire texts for the short term, they are less able to apply theoretical concepts and principles to varying contexts, and less likely to retain knowledge in the long term. This type of learning seems to be prevalent. Novak (1990b) studied the learning patterns of Cornell University students and found that the majority engaged in rote learning most of the time.

To tackle the problem of rote learning, Professor Joseph D. Novak and his research team developed the concept mapping technique. Subsequent studies have found that concept maps facilitated meaningful learning as opposed to rote learning (Okebukola and Jegede, 1988; Heinz-Fry and Novak 1990; Briscoe and Ulerick LaMaster, 1991). Concept maps allow students to connect concepts and summarise information. Students increase their understanding of subject content as they search for personal meanings of concepts, without which they cannot make connections in the map (Briscoe and Ulerick LaMaster, 1991). It is these benefits that facilitate deep learning.

Although concept maps can facilitate deep learning an issue that cannot be overlooked is whether students of different ability levels benefit from the construction of concept maps. Novak *et al* (1983) and Fraser *et al* (1985) indicated that students of different ability levels benefited from concept maps once they could construct them. Subsequent studies though have yielded more specific results. Brennan *et al* (1996) sampled 1700 students studying Marketing Theory and Practice at Monash University and found that there was a large variation in the students' ability to develop concept maps. Students who demonstrated greater levels of understanding were better at the

"techniques" of concept mapping. The Brennan *et al* (1996) findings were consistent with the Heinze-Fry and Novak result. Heinze-Fry and Novak used the Scholastic Assessment Test (SAT) scores as indicators of students' general abilities. SAT scores are the criteria used for undergraduate admission in the US. They reported that high SAT students benefited the most from the concept mapping experience. While low SAT students only benefited over a long period of time, that is, months or semesters (Heinze-Fry and Novak, 1990). The delayed benefit for low SAT students maybe due to the fact that it could take students 8-10 weeks to become fully accustomed to the concept mapping technique and to realise its potential for improving their understanding of science (Wandersee 1990, p.929). However, this issue has largely been overlooked in the literature.

A contentious issue that has arisen in the literature was whether it mattered who constructed the concept map. Research in this area has resulted in conflicting conclusions. Novak (1990a p.37) stated that concept maps prepared by the teacher are helpful to students, but only after they had practiced constructing their own concept maps. While Wandersee (1990) stated that the educational benefit accrued chiefly to the mapper, not the person given another's map. However, contrary to this conclusion was the one reached by Willerman *et al* (1991). They concluded that the effectiveness of concept mapping could be attributed to the fact that the teacher, not the student, constructed the concept maps. Their conclusion was supported by the assertion that the teacher constructed concept map was more complete and accurate than the student constructed map and hence it became a better anchor for new information. Furthermore, the use of a concept map as a superior organiser may have provided the students with greater direction for learning the concepts and facts that overlapped with the teacher's test than did the technique of using only discussion of the objectives of the unit (Willerman and Mac Harg, 1991). This is consistent with Horton *et al* (1993) who find no evidence that student prepared maps were more effective than teacher prepared maps.

The issues that were originally discussed in the literature pertaining to concept maps overlooked the social constructionist view on concept maps. This view was pioneered in Roth *et al* (1992) who stated heroically that the process of mapping concepts, as a group activity may be more important than the concept map itself. They argued that the design and the map are only the final products, expressions of the labour that had gone into producing the concept map. While real learning occurred during the process of negotiating, explaining, justifying, and the various operations on propositions (Roth and Roychoudhury, 1992, p.551). This view was shared with Brennan *et al* (1996, p.86). They stated that the power of concept mapping for learners comes from the actual process of constructing the map, specifically in 1) delineating the precise nature of the interrelationships between concepts, 2) linking concepts to other concepts, and 3) determining the hierarchy of the concepts. Other evidence supporting the social constructionist view comes from Marangos (2000) and Okebukola *et al* (1988). Okebukola *et al* found that students working together cooperatively on concept mapping tasks attained meaningful learning better than students working individually.

Concept mapping as an activity has positive implications for students. It has helped promote positive student attitudes (Heinze-Fry and Novak, 1990). This is consistent with Briscoe *et al* (1991) who noted that several students reported that concept mapping

strategies facilitated learning in other classes as well as the class that concept mapping had been originally introduced into. Roth's (1994) paper indicated further evidence of this. In his sample, nearly 90 per cent thought that "concept mapping is a good way of reviewing a chapter" and "concept mapping helps to make sense of the many terms in the chapter, and to organise them into a meaningful whole" (Roth, 1994, p.12). Not only did concept mapping promote positive student attitudes but it has also reduced subject anxiety (Okebukola, and Jegede, 1988).

The literature regarding concept maps has been positive. Overwhelming evidence exists to indicate that concept maps facilitate deep learning and help move students towards a collaborative approach to studying. Although these advantages have been revealed, unfortunately, the economics discipline has largely neglected concept maps. Even though Novak (1990a p.31) has stated that there is "no domain of knowledge (or "skills") for which concept maps cannot be used as a representation tool...". At the same time one must not overlook Novak's conclusion that concept maps or any other learning tool is no "magic bullet", no "quick fix" for classrooms where rote learning predominates (Novak, 1990b). However, as the demand and supply diagram and the accompanying casual relationships have proven to be useful learning tools in economics, there is no reason why concept maps could not accompany these learning tools.

In the study presented here, we combine both the teacher and student constructed concept maps. Our method consists of firstly, the lecturer introducing the concept map into the Microeconomics lecture and secondly, during the tutorials, students constructing concept maps as part of the set tutorial exercises. Hence our method also combines the social constructionist view.

3 Introducing Concept Maps in Introductory Microeconomics

This paper evaluates the effectiveness of concept maps as a teaching and learning tool in Introductory Microeconomics lectures and tutorials. The project aimed to introduce concept maps in the Introductory Microeconomics lectures and tutorials in second semester 2001. The introduction of concept maps into tutorials was combined with the already established collaborative problem-solving tutorial sessions. In the second semester the Introductory Microeconomics class has a lower number of students, which facilitated the pilot nature of the project. One hundred and twenty students participated in the survey.

Students were introduced to concepts maps in the first lecture. The lecturer explained what a concept map is, the usefulness of a concept map and how to construct a concept map. Students were also directed to the hard copy of the unit outline where the conduct of the tutorial was explained, followed by a thorough account of concept mapping. In the first tutorial the assistant lecturer also emphasised the usefulness of concept maps and the incorporation of concept mapping in the tutorial exercises. The first tutorial was designed to allocate students into their groups. The students were then to work with their group throughout the semester and complete designated homework tasks such as tutorial group presentations of homework and group class tasks. A set of homework questions which were to be presented by each predetermined student group

to the tutorial class as their turn arose, was provided by the subject outline. Most importantly, the first question of the weekly homework questions involved the construction of a concept map. The student group presenting their answers would construct their concept map from the concepts provided by the question and their fellow students would comment, agree or disagree with the linkages or even provide their own alternative concept map. Through this process the class constructs a concept map, making the process of learning and understanding a productive and interesting exercise as a result of discussing the links between concepts and finalising the construction of a "class" concept map.

4 Empirical Results

Students studying first year Introductory Microeconomics in the Department of Economics at Monash University at the Clayton campus were asked to complete a questionnaire in the last week of lectures. We received 120 valid student responses. The responses indicated that 57 percent were male and 43 percent female, international students were 42 percent of the sample population and domestic students 58 percent. Students from an English speaking background and non-English speaking background were equally distributed. The subject was compulsory for 75 percent of the students and for 25 percent it was an elective. The results are demonstrated in Table 1.

For the first seven question students could respond by choosing between the options A (always true), B, C, D and E (never true). While the remaining ten questions were true or false or not applicable questions. Overall, students' responses were very positive. In the first question "Concept maps were great" the positive response (A+B) received 55 percent and in the second question "concept maps were easy to construct" 47 percent answered positively. In the question, "Concept maps were easy to understand" 67 percent agreed with this statement while 17 percent answered negatively to the question that "concept maps were time consuming to construct". Thirty-five percent of the students found that during concept mapping they did not understand the concept completely and 59 percent of the respondents found that through concept mapping they could express their ideas in a simple way. Sixty percent of the students reaffirmed the argument that constructing concept maps is more effective in-groups.

In the true or false questions students responses registered as true (50 percent or over) in nearly all the questions. Question 9 "You really need to understand the work in order to construct a concept map" received 83 percent as a true answer, the highest true response. Question 13, "I used concept maps to help with my mid semester exam preparation" received only 38 percent and Question 15 "I have found myself using concept maps in my other subjects" received only 29 percent as a true answer. Questions 13 and 15 were the only questions that received less than 50 percent true answer. However, in sum, the average positive response for questions 1-7 was 53 percent and for questions 8-17 the average true response was 60.3 percent.

TABLE 1
STUDENT REACTION TO CONCEPT MAPS

		Always True A	B	C	D	Never True E
1.	Concept maps were great	20%	35%	35%	8%	2%
2.	Concept maps were easy to construct	5%	42%	30%	19%	4%
3.	Concept maps were easy to understand	20%	47%	24%	9%	0%
4.	Concept maps were time consuming to construct	13%	35%	35%	15%	2%
5.	When I tried to justify my ideas during concept mapping, I found that I didn't understand a concept completely	10%	25%	39%	21%	5%
6.	By concept mapping, I can express complicated ideas in a simple way	19%	40%	29%	9%	3%
7.	Constructing concept maps works best in a group	26%	34%	28%	9%	3%

		TRUE	FALSE	NOT APPLICABLE
8.	Concept maps helped me learn or remember concepts.	75%	22%	3%
9.	You really need to understand the work in order to construct a concept map.	83%	17%	0%
10.	Concept maps made me think of links that I never thought existed.	61%	36%	3%
11.	I used concept maps to clarify ideas that were complicated and confusing	50%	45%	5%
12.	I only constructed concept maps when it was required as "Homework" to do so.	69%	28%	3%
13.	I used concept maps to help with my mid semester exam preparation	38%	57%	5%
14.	I will be using concept maps to help me study for the final exam.	65%	30%	5%
15.	I have found myself using concept maps in my other subjects	29%	66%	5%
16.	I believe concept maps did aid in my learning.	71%	25%	4%
17.	I will use concept maps in future economic classes	62%	26%	2%

5 Conclusion

The students studying first year Introductory Microeconomics in the Department of Economics at Monash University at the Clayton campus in second semester 2001 responded quite positively to the introduction of concept maps in lectures and tutorials. It appears, though, that only a small percentage of the students used concepts maps as a tool for exam preparation and an even smaller percentage did use concept mapping in other subjects. Thus while students found concept mapping as a tool for understanding

concepts in economics they did not extend the effectiveness of this tool in exam preparation and in other subjects. Strangely enough, the applicability of concept maps to other subjects was questioned by the students studying economics.

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LOSING SLEEP AT THE MARKET: AN EMPIRICAL NOTE ON THE DAYLIGHT SAVING ANOMALY IN AUSTRALIA

by

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1 Overview

In a recent provocative article, Kamstra *et al.* (2000) found that the average Friday-to-Monday stock return on daylight saving weekends was 200 to 500 percent larger than the average negative return for other weekends (the so-called 'weekend-effect' market anomaly) and thereby associated with a one-day loss of US$31 billion on the NYSE, AMEX and NASDAQ markets alone. Kamstra's *et al.* (2000) findings appeared to hold not only in the United States and Canada, where the transition to and from daylight saving is broadly similar, but also in the United Kingdom, whose patterns differ from that in North America, and to a lesser extent in Germany. On this basis, Kamstra *et al.* (2000, p. 1010) suggested that if daylight saving was associated with "...the sort of impact investigated here, an obvious policy implication is to do away with the time change altogether".

The essence of Kamstra's *et al.* (2000) argument is that the 'daylight saving effect' is linked with sleep desynchronosis associated with the change in the circadian rhythm and its (negative) impact on sleep patterns. Every Spring at 2:00 a.m. on the first Sunday in April US clocks are moved forward one hour, and the following Fall at 2:00 a.m. on the last Sunday in October clocks are moved back one hour. As with jet lag, where changes in sleep patterns are thought to persist up to five days for each one-hour time zone crossed (Waterhouse *et al.* 1997), the movement to daylight saving time (DST) also compresses the day, while the movement from daylight saving stretches it, and this also impacts upon sleep patterns.

If, and as hypothesised by Kamstra *et al.* (2000, p. 1006), "...sleep desynchronosis causes market participants to suffer greater anxiety about a given situation, *ceteris paribus*, they may prefer safer investments and shun risk in trades during the trading day following such a disturbance in their sleep patterns...this could push down stock prices following daylight saving shifts when the desynchronosis is systematic". In fact, the argument that shifts to and from daylight saving has an impact upon actual behaviour already has parallels elsewhere with Bick and Hannah (1986) and Shapiro *et al.* (1990) studying the impact of DST on psychiatric presentation, and Coren (1996a, 1996b) Lambe and Cummings (2000), Varughese and Allen (2001) and Sullivan and Flannagan (2002) examining its role in traffic and pedestrian accidents.

All the same, there are a number of complications associated with Kamstra's *et al.* (2000) purported daylight saving effect, which may not arise in non-financial market contexts. To

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