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THE ROAD TO TRANSFER: CONCEPT AND CONTEXT APPROACH TO THE SUBJECT OF ECONOMICS IN SECONDARY SCHOOL

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Abstract. In this study we investigated the effects of two treatments supplementing students' regular courses in Economics in pre-university education. Although students may have acquired a reasonable amount of conceptual knowledge as a result of courses in Economics, two deficits may prevent students from achieving transfer. One possible deficit is the lack of rich and coherent conceptual network, whereas deeply understood and well organised domain knowledge is viewed as a prerequisite for achieving transfer. Second possible deficit is that students are hardly able to make connections between the acquired conceptual network and realistic social problems that can be looked at from an economic perspective. Both deficits result in low transfer-value of conceptual knowledge. In an experimental study we compared the effects of two instructional interventions, based on concept mapping as a learning activity, each directed to one of the assumed deficits. 139 high school students of Economics participated, randomly assigned to one of the conditions: Concept and Context. All students took a pre-test and two transfer tests. Students performed significantly better on the concept post test than on the concept pre-test. We consider this result is due to the concept mapping learning activity in both conditions. Maps seemed to be very useful both in concept tasks and in context tasks.

1 Introduction

The aim of education in Economics in secondary schools is shifting from a predominantly academic approach towards making more effort to teach Economics for the needs of students in society, in their current and future lives. From this perspective, education in Economics should enable students to use economic knowledge in daily life, even in the contexts that are different from those in which they acquired this knowledge. When students can apply acquired knowledge in a more or less novel situation, they have achieved the transfer (Marini & Genereux, 1995). In her Model of Domain Learning, Alexander (2003) considers transfer as an ability of experts. She describes the long road to expertise in three stages: *acclimation*, *competence* (*early*, *middle* and *late*) and *proficiency*. Each of these stages is characterised by a certain amount of domain knowledge, interest and types of strategies used. Although in the upper levels of secondary education, students may have acquired a reasonable amount of conceptual knowledge as a result of economic courses, two deficits may prevent students from achieving the transfer. One possible deficit is the lack of rich and coherent conceptual network, even though deeply understood and well organised domain knowledge is viewed as a prerequisite for achieving transfer (Mayer, 2004; Sternberg, 2003). The conceptual network attained by students after instruction often shows gaps. Concepts are missing or relations between the concepts are not well defined. This kind of deficit is normally the effect in case of students learn for a knowledge-oriented achievement test. They learn for reproduction, not for deep understanding. It may be sufficient for near transfer if the context is similar to the studied problem, but it will be not sufficient for far transfer where the context is different from the studied problem. Along near transfer and far transfer as it is concluded by Stark, Mandel, Gruber and Renkl (1999), can be useful to distinguish middle transfer as well. We consider the same stages in this study but we use the terms of near transfer, semi-far transfer and far transfer. We are talking about near transfer when concepts and context are the same as in the instruction; semi-far transfer when concepts are the same but the context is different; far transfer when both concepts and context differ from the instruction.

Second possible deficit is that students are hardly able to make connections between the acquired conceptual network and realistic social problems that can be looked at from an economic perspective. Students do not have the ability to connect the abstract network of concepts to practical phenomena in daily life that can be looked from an economic perspective. And on the other side they are not able to connect the real life situations with the appropriate conceptual network they have in mind that match with the practical phenomena.

2 Learning for transfer in school

We have noticed the two different deficits for achieving transfer, the lack of a rich and coherent network of knowledge and the lack of making connections between the network and the realistic social problems. The ability to transfer however is a necessity for students to look as an economist at real life problems. Perkins (1992 p. 3) wrote:

> Consequently, the ends of education are not achieved unless transfer occurs. Transfer is all the more important in that it can not be taken for granted. Abundant evidence shows that very often the hoped-for transfer from learning experiences does not occur'. Perkins added: Thus the prospects and conditions of transfer are crucial educational issues.

Mayer (2002), Kratwohl (2002) and Anderson (2002) were members of a committee that revised Blooms' taxonomy(1968). This original taxonomy contained a cumulative hierarchy between the three processes: memorizing the concepts, understanding them, and applying the concepts in a context, necessary to achieve deep understanding and transfer. The committee decided to delete the hierarchy. Students can come to an understanding of a concept *while* applying in a context. The question arises as to what contributes most to the ability of transfer strengthening the conceptual knowledge or strengthening making connections between contexts and concepts. In other words; are we following the concept road or the context road to transfer?

2.1 The concept road to transfer

In literature about transfer (Alexander, 1997; Gelman & Greeno, 1989; Salomon & Perkins, 1989) there is an agreement that a basis of deeply understood or processed knowledge or, one can say a well organized body of knowledge, is a condition for transfer. Such a body of knowledge requires meaningful learning. Novak (2002) stated that meaningful learning is defined by a conscious choice to integrate new knowledge into existed knowledge. This prior knowledge (Alexander, 2006 p. 72): 'encompasses all that a person knows or believes, whether positive or negative, accurate or inaccurate, real or imagined, verifiable or nonveriable.' Prior knowledge influences the perception of new knowledge and modifies the mental models or network of concepts. This can hinder the forming of the conceptual models required for the domain knowledge. In the case of misconceptions conceptual change has to take place. Conceptual change is described as a process of accretion, refining, constructing and reconstructing of mental models (Chinn & Brewer, 1993; Vosniadou, 1994). Students must have sufficient time to construct and reconstruct their mental models to develop a well organized body of knowledge to achieve transfer.

2.2 The context road to transfer

The context road has originated from a recent theory of learning, situated cognition or situated action (Brown, Collins, & Duguid, 1989; Engeström, Miettinen, & Punamäki, 1999). This theory emphasises that all knowledge is situated, in a particular time and in a particular place. It is a part of a culture, in which the knowledge has been developed and used. This has many consequences for learning in school. The context in school is very different from the context in real life. It is not very surprising that students do not connect the economic concepts to practical contexts. They possess mainly inert knowledge that will sink in no longer than necessary for their exams. They hardly ever get the opportunity to see the world as a historian (Whitehead, 1957) or in our case, as an economist. That is why the out-of-school situation in which students function must be understood very well (Brown et al., 1989 p. 36) :

> This is not to suggest that all students of math or history must be expected to become professional mathematicians or historians, but to claim that in order to learn these subjects (and not just learn about them) students need much more than abstract concepts and self-contained examples. They need to be exposed to the use of a domain's conceptual tools in authentic activity to teachers acting as practitioners and using these tools in wrestling with problems of the world. Such activity can tease out the way a mathematician or historian looks at the world and solves emergent problems.

Other differences between school and real life are (Resnick, 1987):

1. While problem solving in real life situations is often a collaborative activity, students in school learn mostly individual.
2. In real life problems there are a lot of tools available, such as visual/material tools; in school it is more a matter of mental acting.
3. In school, abstract thinking is common while in real life more context reasoning is used.

Theories of situated cognition emphasize that students need to be exposed to the use of domain specific concepts and methods in authentic activity and 'problems of the world' (Brown et al., 1989). And where it is not possible to join a community out of school for situated learning, 'the world' has to be brought into school. School has to become a community of learners, where students are struggling with each other on the problems of the world. In an experimental study we compared the effects of a concept road to transfer and a context road to transfer. Each of these approaches focuses on one of the deficits described above.

2.3 Concept mapping as a learning activity

Concept mapping is a learning activity that can be used in both the concept road and the context road. Novak (1990) describes a concept map as a compilation of concepts connected by relations. O'Donell, Dansereau and Hall (2002) use the word "knowledge map" rather than "concept map". Besides concepts, they say that a knowledge map can include dynamic relations, static relations and elaborative relations that contain information. We think that conditional knowledge, that can be defined as the understanding of the 'when or why' of strategy use (Alexander, 2006), and situational knowledge, that can be defined as knowledge specific to

a particular situation (Ferguson-Hessler, 1989) can also be included in a map. Taconis (1995) made this kind of maps for problem solving in physics. He describes such maps as 'a unit in human memory representing a functional package of knowledge.'

3 Research question

In the previous section we mentioned that meaningful learning occurs when students actively construct and build out the mental models they possess. The formation of a well organized body of knowledge which is the result of that activity is expected to have a positive influence on the ability for transfer. The concept road to transfer is characterized by the acquisition of this well organized knowledge *before* applying it in a context. The context road to transfer is characterized by the acquisition of this well organized knowledge *while* applying it in a context.

The research question of our study is: Which instruction, added to the usual lessons of Economics in the fifth grade of pre–university education, is more effective in obtaining transfer: an instruction aimed at strengthening knowledge of concepts and relations between concepts or an instruction based on constructing relations between knowledge of economic concepts and the real world.

4 Method

This research is an experiment with two experimental conditions with a pre-test and a post-test. The pre-test was administered to check whether groups did not differ in prior economic knowledge. There is one independent variable: the type of instruction. The dependent variables are near transfer, semi-far transfer and far transfer.

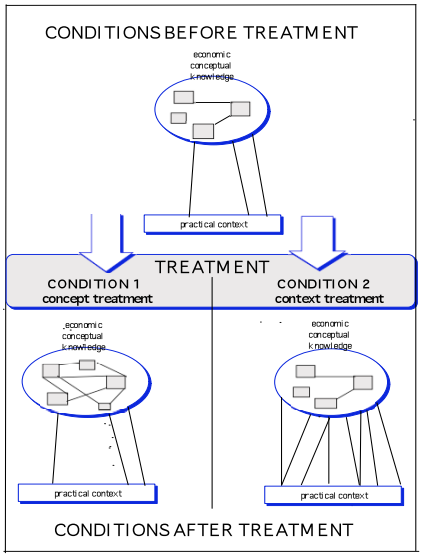

Figure 1. The desired changes in knowledge in concept- and context conditions.

139 students, aged 16 – 18 years old, from eight classes of the 5th grade of pre-university education, from six different schools participated in our study. Within each class students were randomly assigned to one of the two conditions. The first instructional intervention - called *concept-condition* – consists of tasks which challenge students to reconstruct and consolidate their conceptual networks. This intervention is in fact an extension of the instruction that students normally receive in courses on Economics. It is expected to repair the first deficit. The second intervention – called *context-condition* – consists of tasks that challenge students to strengthen the connections between the conceptual framework and contexts, i.e. economical phenomena in the real world. Figure 1 gives a schematic view of the change we are expecting in the concept- and context condition. The point of departure is the same for the two conditions: the students have concept knowledge at their disposal (acquired in school instruction), but the concept network is not complete and not all concepts are related to each other.

The connections from the conceptual knowledge to the practical context are shown by the lines in between. In the upper part of figure 1 there are not many lines to been seen.

In the lower part of the figure, the effect of our expectations after the instruction can be seen. The concept condition improves the conceptual network and the context condition increases the amount of connections between concept and practical context.

Before the experiment the students followed their traditional school program, a course on money circulation and the economic climate. In the pre-test students' knowledge about these concepts was measured. In both conditions we used a concept mapping task (using the computer program 'Inspiration') as a meaningful learning activity. We thought that it should be possible to add conceptual as well as contextual labels to a map. So we were able to see what connections students made between them.

In both conditions the instruction session took two lessons. The instructions and the test were part of the school schedule: two 50-minute lessons a week. The total experiment covered 2.5 weeks, five lessons all together: two for instructions and three for pre- and post-tests.

5 The learning materials

5.1 Tasks

Both approaches (concept and context) were implemented through a concept-mapping task, in which students worked in pairs. The domain knowledge consisted of the money circulation and the economic climate. Students worked first individually on a concept map using paper, post-its and a pencil. Then they worked in pairs, constructing one concept-map on the computer (using the program called Inspiration) in which they had to reach an agreement. In the second instruction lesson students got information about the subject. With this information they had to reconstruct their first jointly made concept-map. In the task for the concept-condition students were asked to make a scheme of labels and relations to show what the money circulation has to do with the state of the economy in a year when the state of the economy is in balance. Students were given three concepts (labels) they had to use and they were stimulated to use concepts they knew from earlier instruction.

The task for the context-condition was oriented towards a complex social problem. In the Netherlands a supplementary duty (25 cents) was set by the government on the price of petrol to discourage motorized traffic. Some members of Parliament wanted to discard this supplement with a retroactive effect. Students were to discuss the possible economic effects of this proposal for the society. Students got some examples of practical outcomes and the same three concepts. They were explicitly stimulated to think from the practical context to economical concepts v.v. Both conditions spend the same amount of time on the tasks.

5.2 Information material

The information used in this experiment differed from the textbooks students used in class. The information was fit on both tasks. Besides the economical concepts there was a lot of practical information, so students had an example of how to use economical concepts in practical contexts.

5.3 Tests

All students took four tests:
(a) a pre-test to measure prior domain specific conceptual knowledge. This test consisted of 25 questions. The test was made in a computer test program (wintoets). The item homogeneity was just sufficient: Cronbachs' alpha was .60.
(b) a far transfer test testing the ability of the students to connect *new* knowledge to existing knowledge in a *new* context. The test was labelled '*Five circumstances that mean difficult economic times*'. It entailed writing five texts associated with five economic cartoons allegedly made for the newspaper. The students were informed that the editor accidentally threw away the original stories associated with the cartoons. The students' task was to write appropriate economic texts for the five cartoons. Each student received two scores for this test, one score for the amount of connections between context T and concept C (context-scoring) and one score for the economic correctness of C (concept-scoring) (see Appendix A for details about the scoring). The minimum score was 0 and there was no maximum. The texts were scored by two researchers. Researcher 1 divided the texts in scoring units. Both researchers scored the C units on economic correctness. The definitive scoring was

determined by dividing the correct C units by the total C units. The inter-judge reliability for the context score was good (Cohens' kappa .85), for the concept score sufficient (Cohens' kappa .64).
(c) a near-transfer/semi-far-transfer test. This test consists of two parts, a concept part and a context part:

- a concept post-test to measure conceptual knowledge (a near transfer test for the concept condition and a semi-far transfer test for the context condition). This test is equal to the pre-test. The item homogeneity of this post-test (Cronbachs' alpha .72) was higher than that of the pre-test.
- a context post-test to measure the ability to make connections between concept and context instruction (a near transfer test for the context condition and a semi-far transfer test for the concept condition). This test consists of two open questions related to practical problems. The problem of 'abolition of the mortgage deduction' starting from the practical context and 'the economic climate in 2003', starting from the concepts. Students were initiated to make connections between context and concept v.v. Two independent researchers scored the amount of connections made between C and T. The minimum score was 0 and there was no maximum. The inter-judge-reliability was good (Cohens' kappa .85).

6 Experimental procedure

The experimental procedure lasted five sessions, each of 50 minutes: one session pre-test, two sessions treatment, one session far transfer test, one session near- and semi-far transfer test.

7 Hypotheses

We expected that students in the concept condition would perform better on the concept post-test than students in the context condition. We expected that students in the context condition would perform better with regard to making relations between concept and context (context post-test) than students in the concept condition. Furthermore, we expected that the concept-condition would be a better starting point for solving far transfer tasks than the context condition. This expectation is based upon the strong case, made in the literature for the importance of a solid, coherently organized conceptual framework, especially when students have to adapt to new, unfamiliar tasks. Connections to contexts may be desirable, but supplementary. Our hypotheses were the following:

1. The concept condition results in more concept knowledge in the near–transfer/ semi–far–transfer test, compared with the context condition.
2. The context condition results in making more links between concept and context in the near–transfer/semi–far–transfer test, compared with the concept condition.
3. The concept condition results in more concept knowledge and in making more links between concept and context in the far–transfer test, compared with the context condition.

8 Results

There appeared to be no significant difference in prior knowledge between the conditions. No significant difference appeared in the school marks for economy (t = -1.09; df = 1.34.5; p = .28) and in de results of the pre-test (t = -.22; df = 138.1; p = .83).

We expected that students in the concept-condition should perform better on the near transfer-test than students in the context-condition (hypothesis 1). But they did not, as was proved by the results of the covariance analyse (F(3,132) = .059; p = .94). Hypothesis 1 had to be rejected.

This was also the case for hypothesis 2. We expected that the context-condition should result in making more connections between context and concept v.v., than the concept-condition. But this was also not the case (F(3,129) = .356; p = .70). From the results we can conclude that in this research near transfer is not better reached than semi-far-transfer.

The third hypothesis was that the concept-condition should result in more conceptual knowledge *and* in making more connections between context and concept v.v. than the context-condition. The covariance test showed that there were no significant differences between the conditions for the far-transfer-test (concept): (F(3,136) = .213; p = .80) and for the far-transfer-test (context): (F(3,135) = .168; p = 85). We, therefore, had to reject the third hypothesis as well.

The scores on the far-transfer-test (context) are extremely low in both conditions: the mean was nine connections between concept and context or v.v. Because the pre-test concept was equal to the near-/semi-far-transfer-test, it was possible to determine whether students had made progress on conceptual knowledge. From a t-test for paired-sampled test we learned that the total group improved significantly in conceptual knowledge (t = -2.663; df = 132; p = .009).

9 Discussion

In this research, we compared the effects of two roads of instructions to reach near transfer, semi-far-transfer and far transfer: the concept road and the context road. The ability to transfer is an important goal to reach in economic education. To be able to transfer, students must have a deep understanding of the economical concepts *and* they must be able to make connections between contexts and economical concepts. One of the two abilities is not enough for transfer. We designed two instructions: the concept road emphasizing the learning of economic concepts and the context road emphasizing connections between concepts and contexts. Tests were performed on near transfer, semi-far-transfer and far transfer. Our hypotheses that the concept condition would perform better on the near concept test and that the context condition would perform better on the near context test, could not have been confirmed. Also it could not be confirmed that the concept condition, due to the better organized knowledge base, performed better on the far transfer test. But the whole group of students significantly improved in conceptual knowledge. After two lessons all students had more knowledge of economic concepts. We expected that students in the concept condition should acquire more conceptual knowledge than students in the context condition. For that reason, they should be able to perform better on the far transfer test. This was not the case. Probably the ability to make connections between concepts and contexts is a necessary skill. The students in the context condition however learned as many concepts as the students in the concept condition. We would expect that the students in the context condition performed better on the context part of the far transfer test because they have been instructed for that. But that is not the case either. It seems that both conditions have trouble with connecting the context with the concepts. Both conditions performed low on that. Students in the context condition have not learned more on making connections between concept and context than students in the concept condition. The conceptual learning was equal in both conditions. It's possible that this result can be described by the concept mapping learning activity in both conditions. Students working in the context oriented concept map learned as many concepts as students working in the concept oriented concept map.

One of the reasons for the low ability to make connections can be that two added lessons are not sufficient for the students to develop a new ability. In their traditional lessons students are thinking in concepts. Both conditions were working on a concept mapping task. In the concept condition the concept map was aimed to be concept oriented, in the context condition the map was aimed to be context oriented. But in both cases the students were thinking in concepts as they used to do. It is possible that concept mapping is not the best learning activity to perform a context task, but we do not think so. From the examples, we observed that concept mapping is working quite well for it. Conditional knowledge can easily be part of the concept map. But we assume that it takes more time and training to develop this ability.

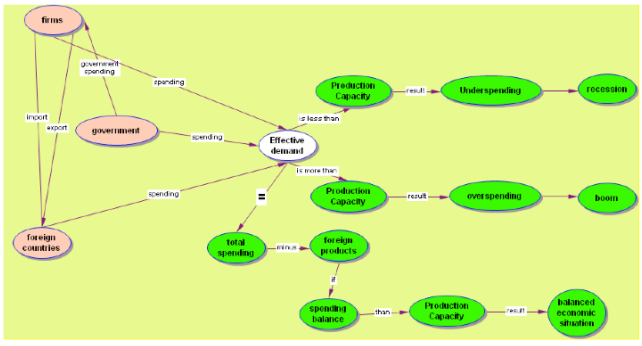

Figure 2. Part of a map made by two students in the concept condition.

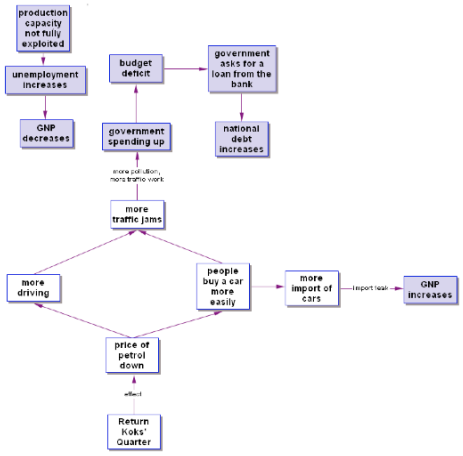

Figure 3. Part of a map made by two students in the context condition

The figures 2 and 3 are showing examples of a concept map, made by students of both, the concept condition and the context condition. The concept condition had to connect the concept of 'money cycle' with the concept of 'state of the economy'. In figure 2 students made that connection by using 'effective demand'. In figure 3 students had to connect contexts with concepts v.v. In the figure you can see two context-concept connections: One is connecting 'more import of cars' with 'GNP increases' and another is connecting 'more traffic jams' with 'government spending up'. Another reason for the inability for far transfer in both conditions can be that, despite the extra training, the conceptual knowledge for both conditions is still not sufficient to reach far transfer. Perhaps, we have overestimated the (deeply understood) knowledge students had acquired in their traditional lessons. Or, it could be explained by the fact that the students followed the instructions only in part. By performing the task students were asked to formulate questions, but they didn't know what to ask and they didn't use the information they had got. Perhaps they needed more feedback than it was given them in this experiment. Bransford and Schwarz (1999) underline the importance of new information and feedback. Working with context tasks can stimulate students to ask for feedback and information. In traditional economic lessons students first learn the concepts, and then they learn to apply them. We followed that tradition in our experiment. But we can assume that this tradition needs to be changed. Context oriented learning can be seen as the framework where concepts are learned *by* researching a context. The Model of Domain Learning (Alexander, 2003; Alexander, Buehl, Sperl, Fives, & Chiu, 2004) describes the development from novice to expert. This model is relating transfer to expert behaviour. The students in this research will be in the stage of acclimation. In this stage, the students are more interested in topic knowledge and not that much in domain knowledge. Partly because of the small amount of domain knowledge students have to turn to surface level strategies to solve problems and they are not capable of processing deep strategies. But by researching the topics, students learn economic concepts related to the topics and that can make them more and more motivated for domain knowledge. That is another reason to change the tradition. It was surprising to see the students to be so motivated in their work. They were working with a lot of pleasure on their task. We think that the concept mapping task on the computer by using the program 'Inspiration' (www.inspiration.com) was the reason for it, both in the concept condition and in the context condition. The last point to consider is that we can wonder if the goal of reaching transfer in pre-university education is possible. Particularly, far transfer proved to be difficult for the students. Bransford and Schwarz (1999) attribute this to the fact that in school expert behave often is being asked. In their model of *Preparation for Future Learning* they emphasize not to go for *Direct Application* but to set the goals on the phases before that, how to question the problem, how to tackle the problem, etc. It is not clear if there is enough attention paid to this in economic education in schools.

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