Facilitating cooperative learning in distance education with 'telecooperation support tools'

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Introduction

The value of interpersonal interaction in the learning process is well known and distance education specialists have long been involved with facilitating such interactions when participants are not face-to-face. Many of these strategies relate to improving communication – in quantity, speed, and quality – between students and tutors. More recently, technologies involving different kinds of teleconferencing – audio, video or computer – are being explored as ways to enrich student-student as well as tutor-group interaction (e.g. Mason and Kaye, 1989). However, evidence is continually developing that cooperative work and collaborative problem-solving are also important aspects of learning. Moreover, they could help overcome some important disadvantages of distance learning, such as feelings of isolation and consequent motivation problems experienced by students (Mulder and Wolswijk, 1991). In this paper we will present our ideas on how technology design may facilitate the implementation of cooperative learning in distance learning.

Cooperative learning at a distance

Cooperative learning methods generally require structured and goal-directed interactions, and additional facilities such as documents for reference in task-related communication; with these requirements teleconferencing facilities alone are inadequate (Davies, 1989). What is required, in addition, is technology design to support communication processes. In our analysis of cooperative working and learning situations we have identified three types of processes – all occurring to a greater or lesser extent – that should be supported in order to have an effective and efficient group working situation (Heeren and Collis, in press): (a) cognitive processes, individual as well as group processes, that are directly involved with a task performance (b) social processes, which enhance group feeling and thereby motivation and (c) managerial processes related to 'project' coordination and management. When face-to-face observation and interaction are not possible, as is often the case in distance learning situations, support for these types of processes may be given through appointments and commitments among the co-learners, or by technology design. We are engaged in research into this latter aspect, i.e. the design of technology for enabling and supporting cooperative learning at a distance, which we have called 'telecooperation support tools'.

Telecommunications-supported cooperative learning environments

We expect an improvement in learning can be found in learning environments, so-called telecommunications-supported cooperative learning (TSCL) environments, containing a set of telecooperation tools that can be used by choice; for specific cooperative learning settings particular combinations of these tools may be preferred (Van Eijkelenburg, Heeren and Vermeulen, 1992). We do not expect that separate tools should be provided for every type of cognitive, social or managerial process. Furthermore we think that a learning environment should be designed in such a way that a synergy arises: a tool should become more powerful when combined with other tools.

At least two types of telecooperation tools should be included in a TSCL environment. Firstly communication tools are needed for social as well as task-related and task management-related communication. These tools may be textual, auditory or visual, and may be real-time, such as telephoning, or deferred-time, such as electronic mail. Secondly document-sharing facilities

should be provided, either for sharing in real-time (screen sharing at a distance), or for saving and access by co-learners independent of simultaneous access, e.g. documents saved on a file server.

Document sharing is critical in distant cooperative-learning situations for a number of purposes:

- documents may serve for reference in task-related communication
- documents are a record of 'what you have been doing so far', and can therefore serve as an external group memory
- documents can also be used for explaining emerging thoughts about subject matter, for example, by scribblings and drawings that 'are worth a thousand words'
- documents themselves may be a stimulus for new ideas, for further thinking and learning
- documents created while cooperative learning takes place may serve as a direct input for documents that may be created as an end product of the group work.

An extra reason to increase the focus on documents is the absence of most if not all non-verbal behaviour in distance learning. The need for including other tools, such as task-division tools, or thinking tools, may be dependent on the specific learning situation and the needs of the group.

Our research focuses on the possible benefits of including one particular type of document-sharing tool, a 'concept mapping tool', in a TSCL environment. A concept mapping tool allows learners at a distance from one another to develop a shared visualisation of the problem space in a task situation by the technique of concept mapping which not only results in shared documents; the technique itself also enhances learning. The research is being carried out in the larger framework of design, development and trials of TSCL environments for various learning settings for cooperative learning at a distance. In the remainder of this paper we focus on concept mapping as a telecooperation tool for document sharing and communication.

Concept mapping

Concept mapping is a technique of graphically representing knowledge or information. The technique is based on schema theories about how human memory works (Norman, 1982; Novak and Gowin, 1984). Through concept mapping the most important concepts in a domain of study are identified, as well as their interrelationships; a 'concept map' is drawn for a particular subject to represent the concepts and relations of elements of that subject. Figure 1 gives an example of a concept map. A variety of applications of this technique exists, but an accepted function of concept mapping is eliciting thinking and learning processes in the concept mapper's mind: thus, concept mapping has been regarded as a study technique used by individuals (Holley and Dansereau, 1984; Novak and Gowin, 1984). Several computer programs exist that facilitate concept mapping (Kommers, Jonassen, and Mayes, 1992), so that easy manipulating and rearranging of elements in the map is possible; this improves the quality of the map as well as potentially enhancing the user's cognitive processes. These programs are called 'concept mapping tools'. The concept map in Figure 1 was created using the program 'Learning Tool' (Van Roekel, 1986).

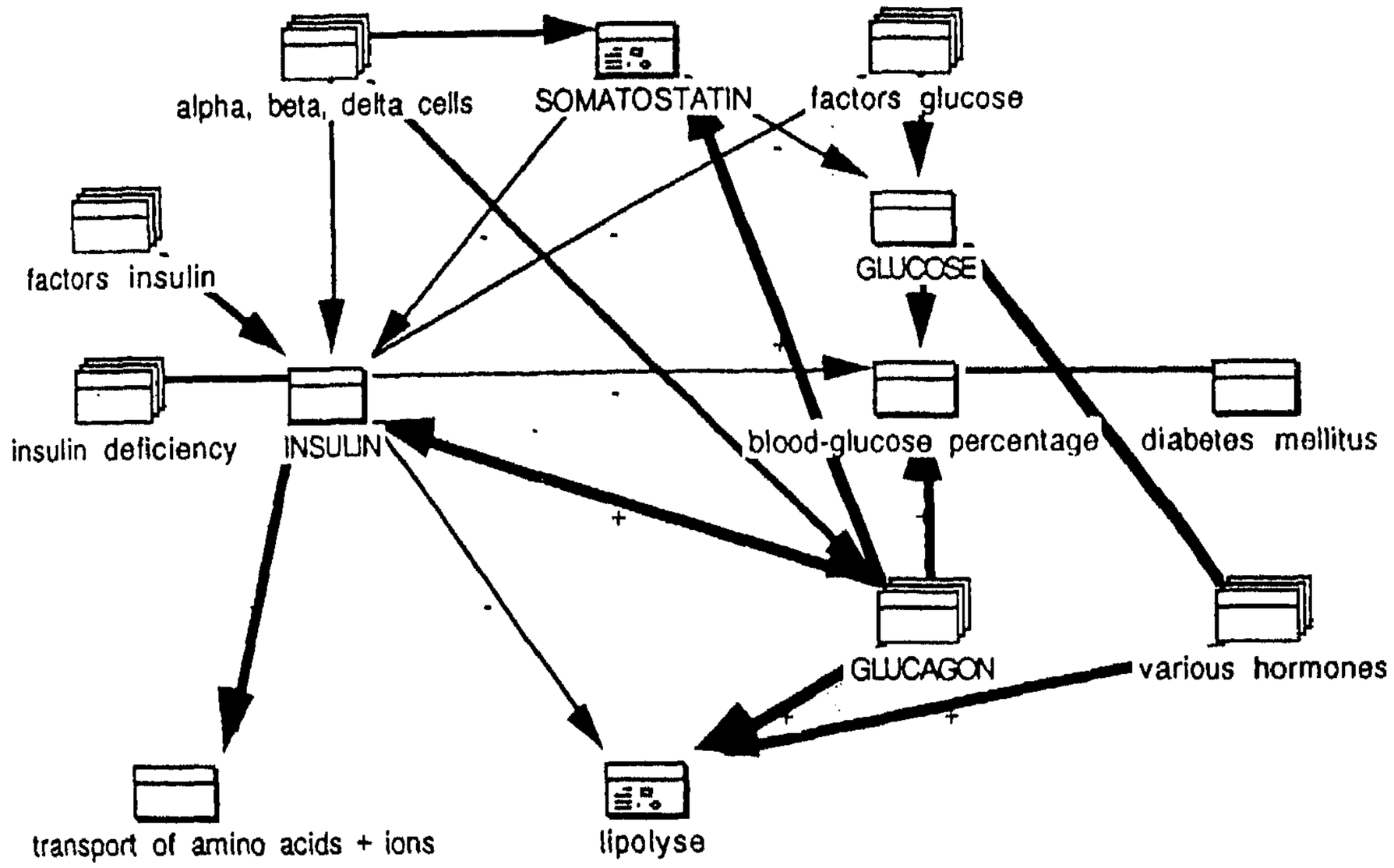

Figure 1. Example of a concept map, created with a concept mapping tool.

Cooperative concept mapping

In an earlier project (Heeren and Kommers, 1992), design features of concept mapping tools were studied and, based on experiences with university students using one of three existing concept mapping tools, a new electronic concept mapping tool was designed. This study focused on the use of concept mapping tools by individual learners, who were given a text to study. Informal reports by subjects in this study as well as by several others indicated that concept maps made while studying individually were also used in talking about the mapped subject matter with fellow students and teachers. This gave us the idea that concept mapping might be a valuable tool in cooperative learning situations.

In cooperative learning settings a cooperatively created concept map might serve as a shared explicit memory. Making knowledge explicit is one useful characteristic of cooperative learning methods. The shared concept map can serve as a basis for reference in communication about the subject matter, which is then a stimulus for new (individual and group) thinking processes. Besides, the map can serve as an input for documents that may have to be created. Cooperative concept mapping is thus in theory a potentially valuable strategy for learning.

Cooperative concept mapping at a distance

Cooperative concept mapping may take place by two or more learners sitting behind one computer that runs a concept mapping tool (software program). This situation has some practical value but we believe that cooperative concept mapping is particularly useful for groups of two or more learners who are not located in the same room as in distance-learning settings. Especially in these situations the advantages of having a generic shared 'external memory', with the functions stated earlier, may be substantial. Additionally, we think that because of its particular structure the concept mapping facility may serve as the core tool in a TSCL environment, to which other tools can be attached. The idea of concept mapping can

easily be related to that of hypertext. When viewing concepts in a map as hypertext nodes, hypertext is created when texts are attached to concepts, with the relations in the concept map serving to link the text nodes. One can even think of directly attaching task-related communication acts (e.g. in text windows) to the elements in a concept map to which the communication refers.

Implications for distance education

In our research we are examining closely how adult learners can conjointly make use of an electronic concept mapping tool while cooperating on a problem-solving task. We are exploring the sorts of requirements distant learners have when using a concept mapping tool at the same time and thus are able to use telephone or other telecommunications links to communicate in a close-to-normal way with one another. We are also exploring the strain on communication that comes when learners will refer to the concept mapping strategy at different times from one another, so that real-time communication cannot occur.

Both cases have significant implications for distance education. Being able to share a visualisation of a problem domain or a conceptual area can help learners from different backgrounds to 'see' what others think are meaningful relationships within a conceptual area. This visualisation may prove especially helpful when cooperating learners are working in non-mother tongue languages. Telecommunications technologies, for example, implemented to include the use of a cooperative concept mapping tool, have considerable potential to enable and enhance processes of cooperative working in distance learning settings, when clarifications of concepts and relationships cannot occur in a spontaneous and visualised way as often happens in face-to-face settings.

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