CONSTRUCTING KNOWLEDGE MODELS. COOPERATIVE AUTONOMOUS LEARNING USING CONCEPT MAPS AND V DIAGRAMS

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Abstract. This paper describes an experience in the construction of knowledge models, conducted at the Public University of Navarra (Spain), during the 2006/07 academic year, with 120 student teachers. The subject area was Knowledge of the Natural, Social and Cultural Environment and the objective was to create knowledge models based on the characteristics of the different areas of the Botanical Gardens at the Public University of Navarra. It was an experiment in cooperative, autonomous learning, using concept maps, V diagrams and CmapTools software. The results clearly illustrate the effectiveness of the teamwork, the high degree to which the students were able to master the targeted instructional techniques, and the importance of these techniques in creative knowledge construction and the acquisition of key basic skills for their future careers. The positive attitude shown by all the students at every stage of the experience added value to the final outcome.

1 Introduction

Cooperative learning is a movement based on a set of theoretical principles and a mode of group organisation, according to which a group of students must collaborate to achieve a more meaningful learning outcome for all members. The research, first undertaken by the Geneva School, suggests that peer interaction is more effective than student-teacher interaction when it comes to achieving a more balanced exchange and promoting knowledge construction. In this vein, Vigotsky (1979) established the notion of the Close Development Zone to refer to the difference in the level of tasks that pupils are able to undertake with the help of their peers and the level of tasks they are able to undertake independently. Due to the assimilation process it involves, social interaction is the origin and driver of learning and intellectual development. Other research works (Johnson, 1981) have demonstrated that pupil-to-pupil relationships play a key role in achieving the educational goals proposed by the teacher (Lobato, 1998).

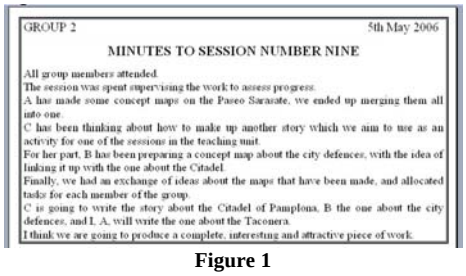
Bearing in mind that these theoretical assumptions can be operationalised with the help of CmapTools, a computer program designed to support collaboration in cooperative knowledge construction and knowledge sharing and thereby facilitate meaningful learning (Albisu, San Marín, González, 2006: Novak & Cañas, 2003, Cañas et al., 2004), this paper presents an experience inspired by the principles described above, in which student teachers at the Public University of Navarra will be set the task of constructing knowledge models based on the characteristics of different areas of the university's botanical gardens, using methodology based on cooperative, autonomous learning.

2 Methodology

The experience was conducted during the 2006/07 academic year with 120 student teachers, specialising in infant, musical and foreign language education, as part of the subject area of Knowledge of the Environment during their teacher-training course at the Public University of Navarra. It comprised the following stages:

2.1 Stage one

The experience began with an awareness-raising session in which the students were presented with the learning task and divided into groups. The learning topic and objectives were also explained during this stage. The various groups were asked to create a Knowledge Model on the subject of the botanical gardens on the university campus. The students had received prior instruction in the use of CmapTools Software and the construction of "V" diagrams (González, 2008).


GROUP 2 5th May 2006

MINUTES TO SESSION NUMBER NINE

All group members attended.
The session was spent supervising the work to assess progress.
A has made some concept maps on the Paseo Sarasate, we ended up merging them all into one.
C has been thinking about how to make up another story which we aim to use as an activity for one of the sessions in the teaching unit.
For her part, B has been preparing a concept map about the city defences, with the idea of linking it up with the one about the Citadel.
Finally, we had an exchange of ideas about the maps that have been made, and allocated tasks for each member of the group.
C is going to write the story about the Citadel of Pamplona, B the one about the city defences, and I, A, will write the one about the Taconera.
I think we are going to produce a complete, interesting and attractive piece of work.

Figure 1

The students were divided into groups of 4-6, and two members of each group were assigned as group leaders, one to take charge of the material and write fortnightly reports on the group's progress, and the other to supervise all the assignments to be completed using CmapTools. Figure 1 shows an example of one of these reports.

2.2 Stage two

This was when the students began the teamwork, (Figure 2) which was supervised at all times by the teacher-educators. It was while preparing the theoretical basis for their assignment that the first discussions, debates and problems arose, requiring the students to work towards a consensus, share meanings and interpretations, and establish agreements accordingly. The fortnightly reports, written up in class, helped to put the importance of these dynamics into perspective.

Figure 2

To find the information they required, the students used the University library to consult the bibliographic sources indicated by the teacher-educators. All group members also made frequent visits to the gardens to observe the trees, bushes and flowers throughout the changing seasons. This enabled them to take note of the characteristics of the different plants on observation cards specifically designed for the purpose. Other data sources were photographs, videos and semi-structured interviews with the gardeners.

All this work was reflected in the knowledge models created by the various groups.

Figure3 is the map of the basic knowledge model constructed by one of the groups with the link to the corresponding V diagram partially opened, and figure 4 offers a partial view of the knowledge model created by the same group with some of the links opened. The HTML versions and CD-ROM recordings of the knowledge models created by the various groups were handed in to the teacher-educators.

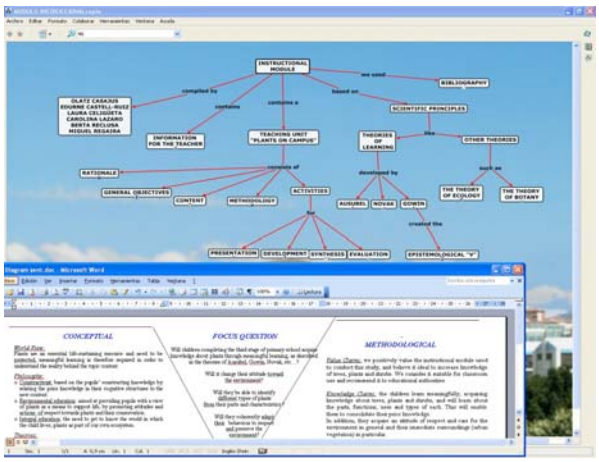


Figure 3

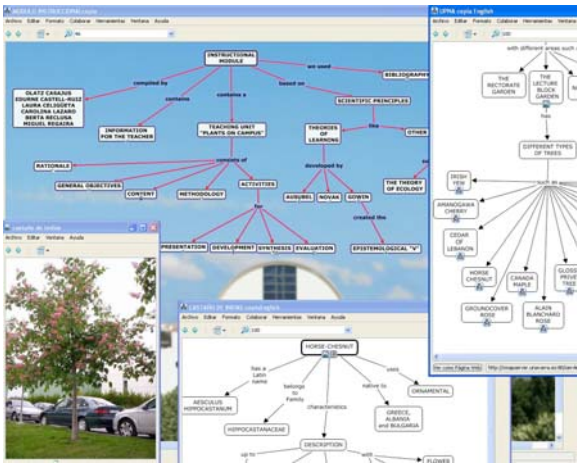


Figure 4

2.3 Stage three

Each group presented its work to the others using ICT resources (computer and video projector), in 20- minute presentations.

Figure 5 shows one of the groups during their presentation.

Figure 5

3 Results and discussion

Analysis of the knowledge models created by the various groups of students revealed a logical correlation between the theoretical and practical domains of the different Vs, and also the remarkable precision of the epistemological elements contained in each of them. The scores on the indicators established by Guruceaga & González (2004) also showed the high quality of the concept maps created by the various groups. The richness, variety and creativity that went into selecting the resources associated with the concepts in all the maps were also clearly apparent.

The fortnightly reports and the analysis of the replies to the final questionnaire put to the students, (Figure 6) allowed us to verify the theoretical rigour with which the students had undertaken their task. This was particularly apparent in the positive interdependence achieved in their teamwork, and the facility with which the students, who belonged to similar levels of the Close Development Zone, were able to achieve social knowledge construction. It was also obvious that they had acquired some of the key competencies contributing to their future careers, such as the development of skills in oral and written communication, analysis and synthesis, meaningful learning and creative knowledge construction, and that the synergy and empathy between group-members had increased. Figures 3 and 4 offer excellent examples of the rigour with which the students created their knowledge models. The map shown in figure 3 shows the hierarchical ordering and transparency of the concepts and the clarity of the processes and outcomes. It is also worth noting the rigorousness of the V constructed by this group. Figure 4 shows a partial view of the knowledge model constructed. It also reveals the high-quality of the resulting concept maps and the selection of resources.

The oral presentation was a further manifestation of the high degree of coordination between the various group members, the ease and expertise with which they used the technological aids, and their remarkable verbal fluency, all of which revealed the seriousness and strict adherence to the instructor's guidelines with which they had undertaken the assignment. The experience clearly showed that the information collected by the students in the initial stages of the process had, by the final stage, been transformed into useful knowledge (Meichembaum & Biemiller, 2000). From the emotional point of view, the group members displayed from the start a highly favourable attitude towards the task, thus adding value to the outcome and strongly promoting the achievement of meaningful learning.

ADVANTAGES AND DISADVANTAGES OF WORKING IN A GROUP

There are many advantages to working in a group:

- " 12 eyes can see more than two ": by this I mean that there is much more richness and creativity when it comes to producing a report. The end product is better because all the ideas are expressed, discussed, united links emerge, etc...
- It helps to prepare us for our professional careers: because in school one has to work it in a team towards a single objective which is to ensure the best education for our students.
- It is more fun: it's not the same researching on your own as having someone with whom to talk over the findings, verbalizing helps you to see things more clearly.
- You learn from others: you see other ways of working, selecting, deciding, analysing, organising, that is, different ways of going about things: this helps you to reflect on your own work.

The disadvantages are:

- Trying to arrange meeting times to suit everyone.
- Some discussions take up a lot of time and, although it's not wanted, it does mean that time is in short supply.
- Having to give in to the rest of the group when you are completely sure of how to go about doing something and the rest of the group disagrees with you.
- Although it didn't happen in the case of assignment, I think there are groups where some members do all the work and others do nothing, and bossiness is also a problem in some groups.

Figure 6

4 Conclusions

This research demonstrated the advantages gained in the creation of a Knowledge Model through the use of Concept Maps, Gowin's V and CmapTools computer software, by teams working in a cooperative and highly autonomous environment.

The knowledge models analysed revealed the high level of expertise in the use of concept maps and V diagrams achieved by the students and key role that this plays in processes involving creative knowledge construction, meaningful learning and the transformation of mere information into useful knowledge.
This experience in teamwork has enabled the students to acquire a series of basic skills that will be of great use to them in their future careers. These include the ability to work in a group, to generate synergy and empathy between group members and to communicate orally and in writing. All aspects of both the process and the outcome were optimised by the level of attitudinal and emotional involvement among the students, which gradually increased throughout the experience.

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