Student Elaborations and Knowledge Construction in Asynchronous Discussion Groups in Secondary Education

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Abstract: Empirical evidence reveals positive effects of collaborative learning on students' cognitive and social development. In daily secondary education, however, collaborative learning and CSCL in particular is scarce. This study examines the potential of asynchronous discussion groups in secondary education for two subjects (biology and history). More specifically, the study focuses secondary school students' elaborations and on the quality of knowledge construction. Therefore, content analysis was applied. The results indicate that students are generally discussing on-task and are engaged in sharing information and asking questions. Unfortunately, students appear to strand in this phase of sharing and comparing information and rarely reach higher levels of knowledge construction. Further, the results reveal involvement in metacognitive interaction, focused on planning and instructing other students.

Objectives

Notwithstanding the fact that a large body of empirical evidence reveals positive effects of collaborative learning on students' cognitive and social development (Johnson & Johnson, 1996, 1999; Lou, d'Abrami, & Apollonia, 2001; Slavin, 1995), collaborative learning and especially computer-supported collaborative learning (CSCL) is rarely applied in secondary education. In this respect, the present study examines the potential of online asynchronous discussion groups in secondary education for two different school subjects.

Much of what students are learning appears to depend on how they interact during peer learning. More specifically, research has shown the constructions of elaborations play an important role in small group learning (Fuchs, Fuchs, Karns, Hamlett, Dutka, & Katzaroff, 1996; Webb & Farivar, 1994, 1999). The construction of elaborations not only appears to constitute a critical mediator of successful collaborative learning activities in the context of small group learning. In addition, the provision of extended elaborations can be expected to promote the social construction of knowledge because the provision of such explanations not only compel students to externalize and verbalize their thoughts but also make their ideas explicit and accessible to both themselves and others (Van der Linden, Erkens, Schmidt, & Renshaw, 2000; Van der Meijden, 2005).

The present study particularly focuses on examining secondary school students' elaborations in asynchronous discussion groups. Further, the quality of students' knowledge construction is studied. The study also focuses on factors that explain why asynchronous discussions sometimes fail. In this respect implementation guidelines are formulated and discussed.

Theoretical Framework

Learning in CSCL settings can be considered as a specific type of collaborative learning. The theories of Vygotsky and Piaget support the mechanisms through which students learn in collaborative environments. Both theories have emphasized the role of the social context in the construction of knowledge and stress that peer interactions provide a necessary context for the revision of developing cognitive systems and creation of new meanings or knowledge. Researchers in the Piagetian tradition use the concept of socio-cognitive conflict to specify that when two contrasting world views are brought into contact, this is likely to stimulate some cognitive restructuring, learning, and improved understanding (Mercer, 1996). Vygotsky's sociocultural theory emphasizes that having to explain ideas to each other is useful because it encourages the development of a more explicit, organized, distanced kind of understanding (Mercer, 1996).

The present study specifically focuses on students' elaborations in CSCL and the ongoing social construction of knowledge. It is more particularly assumed that a collaborative learning situation stimulates the verbalization and explicit formulation of the concepts under discussion (Van der Linden, et al., 2000). Furthermore, explicit verbalization is assumed to help students become aware of the cognitive and metacognitive processes involved in the execution of a task and students have been found to particularly learn from elaborated help to others (Webb & Farivar, 1994). In this respect, discussing online is an excellent activity for co-constructing knowledge, since explaining, elaborating, and defending one's position to others "forces learners to integrate and elaborate knowledge in ways that facilitate higher-order learning" (Rourke & Anderson, 2002, p. 3).

Participants

The participants were 84 fourth year secondary school students (64 girls and 20 boys) from 4 different classes. The students had no prior experience with working together in asynchronous discussion groups.

Collaborative task and procedure

Groups consisted of 3 to 4 students and were composed heterogeneously by the participating teachers. In total, 46 discussion groups were involved in the collaborative task.

The subject areas included in the present study were natural sciences (i.e. biology) and social sciences (i.e. history). The participating teachers selected a topic from the regular science and social studies curriculum. The students were instructed on the use of the discussion forum, the collaborative task was introduced, and students were assigned to groups. Afterwards, the groups of students formulated their own research questions and activated prior knowledge on the topic. The students were encouraged to post their research questions and to answer and comment on each other's work. The groups tried to find the answers to their research questions by collecting information from the library, the Internet, and interviews. In the end, all of the groups summarized the information to answer their research questions and commented on the summaries provided by the other groups.

Data sources and analysis

Content analysis was applied to study students' elaboration and the ongoing processes of social knowledge construction reflected in the discussions. In this respect, two different coding schemes were applied on the transcripts. The first coding scheme is based on the work of Van der Meijden (2005) and the second coding scheme builds on the work of Gunawardena, Lowe, and Anderson (1997)

For all participating groups, the complete discussion transcripts were analyzed. In this respect, a total of 2825 messages was involved in the analysis. In the present study the whole message was used as the unit of analysis. According to Rourke, Anderson, Garrison, and Archer (2001) this results in an objective identification of all units of analysis.

Two coders coded the messages independently. Prior to the coding of the discussions, both coders went through a training program. Inter-rater agreement was calculated on the basis of a random selection of 360 messages (12.74%). The percent agreement was found to be 96.94% for the coding scheme of Gunawardena et al. (1997) and 85% for the coding scheme of Van der Meijden (2005). Cohen's Kappa was respectively .94 and .81.

In addition to the content analysis of the discussion transcripts, a questionnaire was administered to assess students' perceptions of collaborative learning and constructing knowledge in online discussion groups. This questionnaire was based on the work of Van der Meijden (2005).

Research questions

In the present study, the following research questions are addressed:

- How can the interaction of secondary school students in asynchronous discussion groups be characterized in terms of cognitive, affective, and metacognitive contributions?
- What is the quality of the process of knowledge construction of secondary school students engaged in asynchronous discussion groups?
- Does school subject influence students' elaborations and achieved levels of knowledge construction.

Next to that, the implications with regard to the implementation in the classroom are studied.

Results and conclusion

As to interaction characteristics of the students, cognitive, affective, and regulative contributions and participation were explored using the coding scheme of Van der Meijden (2005). In this respect, it appears that 55.7% of the messages are cognitive in nature. More specifically, in the present study 5.1% of the contributions focuses on asking questions, 3.1% concentrates on giving answers, and in 47.5% of their messages students share information. 6% of the posts contain affective messages, 5.4% are non-task-related remarks and 32.9% of the contributions focus on regulation and metacognition, indicating students' need for structure and task division. The large percentage cognitive contributions corroborates the results of the study of Van der Meijden (2005) in secondary schools. The occurrence is, however, considerably smaller than the results for higher education students working together in an online environment (Schellens, 2004; Veldhuis-Diermanse, 2002). An explanation for this difference can be related to the level of the students.

When taking into account the coding scheme of Gunawardena et al. (1997), it appears that 44% of the messages could not be coded using one of the distinguished phases of knowledge construction, since they focused primarily on the practical course of the discussion, the division of tasks, social messages, or off-topic content. Further it appeared that students' messages were mainly restricted to sharing and comparing information (52%). It was only exceptionally that they identified areas of disagreement (2.4%), negotiated meaning and engaged in co-construction of knowledge (0.1%), or reached agreement and applied the co-

constructed knowledge (1.5%). These results confirm the findings of Gunawardena et al. (1997) and McLoughlin and Luca (2000).

As to the third research question, no differences were found in the number and quality of students' elaborations and achieved levels of knowledge construction depending on the biology or history subject. Additionally, the questionnaires concerning students' perceptions of collaborative learning reveal that the online learning environment has caught on well with the students. They were generally satisfied with the collaboration in group and appreciated this instructional strategy as a supplement to the usual face-to-face classes.

In conclusion, we can argue that the implementation of asynchronous discussion groups can be fruitful in fostering collaborative learning in secondary education. Students are satisfied and recognize the value of online collaboration. Further, they are generally discussing on-task and they are engaged in completing the assignment by sharing information and asking questions. Unfortunately, students appear to strand in this phase of sharing and comparing information. They rarely reach higher levels of knowledge construction, implying that secondary school students need more steering and support, especially when they lack experience in discussing online. In this respect, the findings reveal room for improving the design of online discussion environments in secondary education and support the results of previous research indicating the feasibility of training discourse features. Further, the results reveal that students are also involved in metacognitive interaction, focused on planning the task and on instructing other students.

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