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The Effect of Task and Collaboration Support on Learning Processes and Learning Results in a CSCL Environment

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Abstract: This study investigates the effect of two types of support (i.e. task/domain and collaboration) on students' learning processes and learning outcomes. Several meta-analyses were conducted. The results show that students who received support for collaboration had higher individual learning outcomes and a better collaborative and cognitive process than non-supported students. Further, students who received support for the task/domain had higher individual learning outcomes and a better collaborative process than students who received no support.

Keywords: CSCL, meta-analysis

Introduction

Learning in computer-based learning environments is often supported by scaffolds. These scaffolds can focus on the task and domain or on the collaboration. Traditionally, the task and domain are supported by cognitive scaffolds. These scaffolds support students in processes such as formulating hypotheses and creating experiments (Gijlers, Saab, van Joolingen, de Jong & van Hout-Wolters, 2009). An example of such a scaffold is a concept-map (Novak, 1990). Constructing a concept map requires students to pay attention to the key concepts of the domain (Nesbit & Adesope, 2006). Besides, various scaffolds are available for collaboration. A popular way to support collaboration is for example offering collaboration or communication rules to students. Mercer and colleagues (e.g. Mercer, 1996) have performed several studies where they provided instructions for effective communication in a collaborative learning setting. Overall the results of the work of Mercer and colleagues showed that the quality of students' conversation or talk improved when they received instruction in effective communication (e.g. Mercer, 1996; Rojas-Drummond & Mercer, 2003).

This study investigates the effect of these two types of support in CSCL environments. The aim of this study is to examine the relation between the two kinds of support (i.e. task/domain and collaboration) and students' cognitive and collaborative learning processes and students' learning outcomes.

Method

Search strategies and criteria for inclusion

For this review, systematic search actions were conducted from May 2014 through August 2014 in three online databases (i.e. PsycINFO, ERIC, and Web of Science). The search was restricted to publications from the years of 1990 through 2014. Examples of keywords we used for this search were *computer supported collaborative learning*, *CSCL*, *cooperative learning* and *computer-mediated communication*. The search generated 15555 publications. First, duplicates were removed and from the remaining 7536 publications we assessed whether or not the study met the predefined inclusion criteria: a) The study had to measure the effect of collaborative learning on cognitive outcomes, b) The study should have a description of the CSCL arrangement, c) The communication should go through computer or face-to-face behind a computer, d) The domain and learning task had to be described, e) At least one form of collaboration and/or one condition requirement had to be investigated, f) The group size should be between 2 and 5 participants, g) The study had to investigate CSCL in students from elementary or secondary education, and h) Each article should contain quantitative data. Two researchers independently reviewed 10.6% of the publications based on inclusion criteria: the Cohen's inter rater reliability was .84 (Landis & Koch, 1977).

Coding and analysis

After the application of the inclusion criteria we included 39 remaining studies in the final dataset. Articles from the final dataset were coded with a coding scheme existing of three categories: 1) *Support* (task/domain, collaboration), 2) *Learning outcome* (individual, group, a combination of individual and group, or no learning outcomes), and 3) *Learning process* (collaboration, cognitive, both kinds or no learning process). Two

researchers independently coded 22.1 % of the studies in the final dataset by means of the coding book. The Cohen's κ for each category: support .85, learning outcomes .89 and process component .71.

From each study, separate effect sizes for one or more of the four dependent variables (i.e. individual learning outcome, group learning outcome, collaboration process, cognitive process) were extracted. For each of these variables, an effect size (*Cohen's d*) and variance were computed. In total, 85 effect sizes were extracted from the 39 studies.

Findings

Effects of support on students' learning outcomes

Students who received support on the task and domain had higher individual learning outcomes than students who received no support. A small to moderate mean effect size was found, $d = +0.33$, $SE = 0.09$, $k = 18$, $CI_{95\%} = [0.16; 0.51]$; $p < .01$. However, students who received support on the task and domain did not have higher group learning outcomes than non-supported students. A non-significant, small to moderate mean effect size was found, $d = +0.39$, $SE = 0.21$, $k = 14$, $CI_{95\%} = [-0.01; 0.80]$; $p = .06$.

Students who received support on collaboration had also higher individual learning outcomes than students who received no support. A small to medium mean effect size was found, $d = +0.31$, $SE = 0.10$, $k = 5$, $CI_{95\%} = [0.12; 0.50]$; $p < .01$. Finally, collaboration supported students did not have higher group learning outcomes than non-supported students. A weak, statistically non-significant mean effect was found, $d = +0.12$, $SE = 0.14$, $k = 8$, $CI_{95\%} = [-0.16; 0.40]$; $p = .40$.

Effects of support on students' learning processes

Students who received support on the task and domain had a better collaborative process than non-supported students. A medium to large mean effect size was found, $d = +0.63$, $SE = 0.22$, $k = 13$, $CI_{95\%} = [0.20; 1.06]$; $p < .01$. On the other hand, students who received support on the task and domain did not have a better cognitive process in comparison with non-supported students. A small to medium, statistically non-significant mean effect was found, $d = +0.28$, $SE = 0.17$, $k = 12$, $CI_{95\%} = [-0.05; 0.61]$; $p = .10$.

Students who received support on collaboration had a better collaborative process and a better cognitive process than students who received no support. A medium to large effect size was found for the collaborative process, $d = +0.53$, $SE = 0.18$, $k = 10$, $CI_{95\%} = [0.17; 0.89]$; $p < .01$ and a small to medium mean effect size was found for the cognitive process, $d = +0.41$, $SE = 0.15$, $k = 5$, $CI_{95\%} = [0.11; 0.71]$; $p < .01$.

Conclusions

This study examined the effect of two types of support on students' learning outcomes and learning processes. We found that students who received support, regardless which support, scored higher on individual learning outcomes than students who did not receive support. Surprisingly, we found that both types of support had no significant effect on group learning outcomes. Further, support of collaboration had a significantly positive effect on both collaboration and cognitive learning processes while support on the task and domain only had a positive effect on collaboration learning processes.

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