Efficiency of learning environment using GeoGebra when calculus contents are learned in collaborative groups.

**Summary:** In this paper we present a modern approach of teaching mathematics based on the computer supported collaborative learning (CSCL) of calculus contents. The collaborative learning was used in calculus course at the University of Novi Sad, Serbia, for examining functions and drawing their graphs. In 2012 the authors decided to improve the collaborative learning introducing GeoGebra application. Small four member groups were formed by using S. Kagan's [Cooperative learning. San Clemente, CA: Resources for Teachers, Inc. (1994)] principles. Two groups of students, the experimental, and the control one were observed. The students in the experimental group learned with the help of GeoGebra, and the students in the control group learned without using GeoGebra. Comparison between those two groups of the first year calculus students, regarding their way of learning and the results achieved, is described below. Before the students’ collaborative learning, they were tested with a pre-test and their knowledge necessary for examining functions was verified. The pre-test showed that there was no significant statistical difference between the experimental and the control group. The experimental group worked with the help of the computer and the control one without it. After the collaborative learning, the students were tested with a test (colloquium) and the results of the experimental group were significantly better than the results of students in the control group. At the end of the course the students did their exams (post-test), and the results of the experimental group were significantly better than the results of students in the control group. Some students from the experimental group had to answer questions in an interview related to the use of GeoGebra during their collaborative learning. In order to see the students’ difficulties in solving problems, students in the experimental group were asked to cross out incorrect parts of solutions, not to erase them. The teachers reviewed the students’ tasks done during the collaborative learning and after that the students who had corrected their mistakes were invited for an interview about using GeoGebra for overcoming their difficulties. Based on the students’ results in the tests, answers in the questionnaire and in the interview, it can be concluded that GeoGebra has enabled an easier learning of this material. The GeoGebra package enables the students to check whether each step in the process of solving a task was correctly done or not. The results of our research show that GeoGebra can help those students having insufficient knowledge (necessary for solving those tasks) to improve it. We can say that our research shows that the students’ learning achievement in examining functions and drawing their graphs is better when they use GeoGebra, working in collaborative groups than without using it. Also, GeoGebra enables creation of effective learning environment for examining functions and drawing their graphs.

---

**Classification:** U75 I25 I45 D45

**Keywords:** collaborative learning; constructivism; function; problem-solving