Workshop
Applying Cooperative Learning Methods in Teaching Computer Programming

Leland L. Beck\textsuperscript{1} and Alexander W. Chizhik\textsuperscript{2}

\textbf{Abstract} - This workshop examines how to use cooperative learning as an effective instructional strategy for teaching computer programming. After an experiential introduction and a brief presentation of theoretical principles, participants will work collaboratively to design and evaluate instructional activities of their own. Participants will also receive a set of cooperative learning activities that they can incorporate into their own programming courses, including guidance and suggestions for applying these exercises in the classroom.

\textbf{Index Terms} - Active learning, Computer programming courses, Cooperative learning.

\textbf{WORKSHOP DESCRIPTION}

This workshop examines how to use cooperative learning as an effective instructional strategy for teaching computer programming. Participants will begin by experiencing cooperative learning for themselves, with special attention to the primary principle of interdependence. Interdependence is fostered by performing tasks that require multiple abilities and by assigning students process-oriented roles that focus on group responsibility. After this experiential introduction, the workshop will continue with a brief presentation of theoretical principles that guide cooperative learning. While focusing particularly on interdependence, the presentation will also take into consideration status hierarchies that can produce inappropriate expectations by group members for each others’ performance, thereby establishing non-optimal cooperative learning conditions. Participants will then work collaboratively as they apply cooperative learning principles to design and evaluate instructional activities of their own. This phase of the workshop will focus on the use of cooperative learning in teaching computer programming; however, the principles that are learned can easily be applied to other subject areas. Participants in the workshop will also receive a set of cooperative learning activities that they can incorporate into their own programming courses, including guidance and suggestions for applying these exercises in the classroom.

\textbf{RELEVANCE TO THE FIE COMMUNITY}

Introductory courses in Computer Science are often characterized by high dropout and failure rates. Although some students seem to grasp the concepts very quickly, many others feel overworked and seem perpetually "lost." Despite the instructor’s best efforts, many of these students do not succeed. There is often a high level of learning frustration (and teaching frustration) in such courses.

Cooperative learning is a well-known educational approach that has been applied with a wide variety of subject matter and a broad spectrum of populations. Experiments with the use of this approach in teaching computer programming strongly indicate that cooperative learning leads to higher student performance and lower attrition. It also appears that cooperative learning may be especially beneficial for female students and students of color. These findings are consistent with the results from cooperative learning experiments in other fields.

These benefits would be relevant to a broad spectrum of students majoring in computer science, engineering, and technology, most of whom must study computer programming as part of their academic programs.

\textbf{INTENDED AUDIENCE}

This workshop is designed for instructors, with or without prior experience in cooperative learning, who want to explore the principles that make this approach an effective instructional strategy. One principle of cooperative learning holds that people with different prior levels of knowledge can learn productively from each other; participants in this workshop will be able to experience this effect for themselves.

\textbf{PRESENTERS’ BACKGROUND}

Dr. Leland Beck has 30 years of full-time University-level teaching experience. He has published an introductory programming textbook and an accompanying series of laboratory manuals for use in different teaching environments. He is also the author of a systems programming textbook that has been translated into four foreign languages. He has served

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Dr. Beck has conducted several projects closely related to the subject of this workshop. These projects included a study of how students learn and think about key concepts as they study programming, and several experiments with cooperative learning in teaching computer programming.

Dr. Alexander Chizhik is an Assistant Professor of Educational Psychology at San Diego State University. Dr. Chizhik is an expert in cooperative learning as well as the assessment and evaluation of educational programs. He has published articles in leading journals on status issues in cooperative learning.

Dr. Chizhik has over ten years experience as a consultant evaluating educational programs, and has been PI on three educational research grants dealing with group learning. These projects include studies of how students learn and think within cooperative learning environments.

Dr. Beck and Dr. Chizhik are the principal authors of a paper on cooperative learning in teaching computer programming that was presented at the ACM SIGCSE conference in February 2005 [1]. They are co-principal investigators on an NSF CCLI grant which will extend the preliminary work that was presented in that paper.

REFERENCES