
**Categories**: student centered learning, active learning, collaborative learning, mathematics

**Summary**

This article begins with a brief discussion of the various notions of cooperative learning as an approach which, as they note, makes defining the term somewhat problematic. For the purposes of their article, however, they propose a set criteria for defining cooperative learning: student learning in small groups of two to six; tasks that require that students depend on one another as well as the group’s work as a whole; a learning environment that offers all members of a group equal opportunity to interact with each other; and, a format in which each member of the group is responsible for contributions and equally accountable for the work of the group. Using this model of cooperative learning, the authors discuss the use of a technique they both employed in math classes and used as the focus of a study.

The authors refer to the technique that they employed as the Exchange of Knowledge method. Somewhat like the Jigsaw exercise, the Exchange of Knowledge model (EKM) makes use of a group setting to promote student learning through interaction with peers, and with each student acting as both teacher and learner. The EKM utilizes a set of pre-prepared study cards, each of which contains three parts: a worked out example problem; a similar problem for the student to work through; and, if applicable, a second more advanced sample problem. The study cards used in any application of the EKM constitute a learning unit, and corresponding homework should be available for each of the problem types represented in the set.

Much like the Jigsaw exercise, the EKM begins with students divided up into “expert groups,” which should be made up of students of heterogeneous ability levels. Each member of the expert group should have the same study card, and as a group they should work together to arrive at a solution for the problem on the study card. Once they have completed this task, students are then broken up into “exchange knowledge” groups, made up of two to six students (one from each “expert group”). Once placed in this secondary group, students work in pairs. In the pairs, each student must explain to his or her partner how to solve the worked out example provided on the study card, and in turn, listen to his or her partner explain that study card problem. Each of the students in the pairing is then required to solve a problem similar to the one explained his or her partner, and may, while in the course of solving, ask for further assistance from the assigned partner. Once each of the students in the pair has completed their respective problem task, the students within the exchange knowledge group form new pairs, so as to ensure that each student in the group has an opportunity to learn about and work through each of the study cards in the set.

Having laid out the methodology, the authors turn their attention to a variety of guidelines for effective usage of the EKM. First, the authors suggest that the groups formed during the exercise range from two to six. Moreover, they argue that within the initial expert groups it is important to ensure that the members represent heterogeneous ability levels. This structure, note the authors, allows for balance and similarity of pace within each of the expert groups. It also allows the instructor the opportunity to
assign one higher level supervisory student to each expert group. Second, the authors suggest that the nature of interaction within each of the groups, though somewhat dependent upon the given task, should be focused on specific, pre-assigned problem tasks. Third, when using the EKM, the instructor should operate as a facilitator, moving from group to group to ensure that interactions are effective and offering help when requested. Finally, the article points out that despite the group based nature of the exercise, assessment/evaluation gleaned by the instructor from the technique should be focused on individual student progress rather than some group based objective.

Conclusions/Findings

Despite failing to offer any specifics, the authors conclude their article by noting that they had conducted a study of the application of the Exchange of Knowledge method. From this study they drew several conclusions about the EKM. First, the method greatly increased the level of active learning in the classrooms in which it was employed. Second, use of EKM led to an increase in "mathematical communication" among the students, which supported increased understanding of math. Third, according to their study, a large majority of help requests made during the method was in use were directed towards student partners, thus increasing the cooperative functionality of the exercise. Fourth, in self-reporting, students registered highly positive attitudes through the use of the method. Fifth, the authors found that student achievement developed through use of thee EKM was at least equivalent to that of students working in a more traditional educational environment. While this last finding might suggest that the method had only limited benefits in terms of mathematical knowledge, the authors pointed out that students were also gaining greater confidence in mathematical communication, expressed a sense of increased comfort in the classroom, and that use of the method provided instructors with greater insight into student knowledge and understanding than they did using more conventional approaches.

Applications

This article offers a seemingly viable approach to spurring greater active-learning and collaboration in math courses, albeit it an overly convoluted fashion. To a large extent, this article really presents a variant of the Jigsaw exercise and offers specific guidelines for its application in mathematics. Once one moves beyond the rather confusing and seemingly disorganized presentation of the method in question, it becomes relatively clear how this method might be applied in math classes and the benefits that might be gained from it. Interestingly, while the article offers quite useful advice as to the logistics of the method, and the possibilities for pairing in-class applications with supplemental out of class work, it seems to miss certain possibilities. One such opportunity would be the ability to utilize this method to present not just one set of questions/study cards, but rather a series, which could then introduce increasing complex concepts that built off of previous iterations of the exercise. Additionally, while the authors suggest that all assessment/evaluation stemming from the exercise should be focused on the individual student, this would appear to be both counterproductive and a missed opportunity to strengthen students teamwork skills. In other words, one might conclude that use of the EKM might both necessitate some level of group evaluation or assessment, and that such an assessment might be beneficial to the students’ progress towards the overarching learning objectives of the course.
Citations of Interest


