COOPERATIVE LEARNING ACTIVITIES WITH A FOCUS ON GEOMETRY APPLICATIONS IN A BASIC MATH & PRE-ALGEBRA CLASS

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Abstract. In this communication, we report on cooperative learning group activities with an emphasis on geometry applications conducted in a Basic Math & Pre-Algebra Class (MATH-192) in Ohlone College. These collaborative strategies are used as an efficient tool, among others, to improve the class climate nature of MATH-192 where the majority students are typically adult working learners and returning students who are in needs to be motivated.

Motivation. In Ohlone College, the Basic Math & Pre-Algebra Class (MATH-192) is typically designated to serve either full-time/part-time working learners and/or returning students who want to regain their confidence in math and to seek basic mathematical skills for solving problems in their daily life. Therefore, the main challenge for instructors who teach this class is how to create class activities in order to keep the students motivated and engaged in the learning process after their long day at work, and even to keep them coming to the class regularly. Along with traditional whiteboard lectures, the instructor should also be willing to design other creative, interactive and innovative activities to achieve a high attendance rate for a 16-week long semester.

Activity. We describe geometry-based application group activities conducted in MATH-192, Fall 2017, using cooperative learning-based approaches. First, to ensure that a group is cooperative, educators must understand the basic elements that need to be carefully structured within every cooperative activity. According to Johnson and Johnson [1], these include:

1. Pre-instructional decisions: Instructors specify the objectives (both academic and social skills) for the lecture and decide how to organize the activity.
2. Clarification: Instructors provide a clear explanation of the task as well as the interdependence and accountability of each group member.
3. Monitoring: Instructors constantly observe, intervene and assist groups in completing the task accurately and effectively.
4. Assessment: Instructors evaluate groups’ performance and learning outcomes, and provide students with suggestions on how to improve their collaboration skills in the future.

MATH-192 is a 5-unit class which uses the Pre-Algebra textbook by Lial and Hestwood [2]. The class meets MTWTh from 10:45am to 2:00pm. The student performance evaluation consists of homework (15%, using MyMathLab, an online interactive and educational system designed by Pearson Education), quizzes/in-class activities (10%), four tests (50%) and a final exam (25%).

The geometric shapes in [2] which need to be covered can be divided into two groups;

• two-dimensional objects such as squares, rectangles, triangles, parallelograms, and circles,
• three-dimensional objects such as cubes, rectangular solids, and cylinders.

Therefore, the concepts to be taught include perimeter, area, volume and surface area. We conduct activities in conjunction with the geometric learning objectives for each of these categories. Because of their similarity, we focus on only one category here.

Activity Implementation (for studying two-dimensional shapes). The class is divided into small groups of three. Using the whiteboard, the instructor introduces the concepts of perimeter and
area together with two-dimensional geometric shapes. Then, abstract examples are given to each group to work with on paper. Additionally, working with geometry concepts only using paper and pencils becomes boring since the students are not able to find/feel actual measurements of the shapes. To overcome this and to reinforce the learned concepts, the second group task, which is also the primarily focused activity of the report, is designed and embedded in the way that requires each group member collaborate to the others harmonically and interactively. With groups of three already set up, the instructor now provides each group with physical manipulatives (we have prepared these teaching aids in advance) including measuring tapes and various carton-based geometric shapes. The members in group are asked to cooperatively perform the following tasks:

- Identify and name the shapes of objects correctly;
- Use the provided tapes to find actual dimensions;
- Choose an object in the classroom to measure its dimensions;
- Evaluate perimeters and areas;
- Write a detailed report of the activity.

In addition to general benefits of group working such as respecting others’ opinion, having the pleasure of being useful, and gaining social skills including leadership, decision-making, trust-building and conflict-management skills (see also, for example, [1, 3]), the academic goals of the activity are achieved:

- Directly applying what has been learned from whiteboard/paper to real life situations; that is, relating the theoretical concepts to applications;
- Using and combining the previously learned skills in Pre-Algebra: rounding, estimating, arithmetic operations;
- Learning how to find the height of triangles and parallelograms;
- And, of course, having more fun with some physical exercise after their long day at work.

Two photos of students measuring classroom furniture can be seen below.

Concluding Remarks. Cooperative learning is one of the most frequently used instructional practices of group activities. It enhances positive interdependence, individual accountability, promotive interaction, and appropriate use of social skills. We have shared the collaborative group activities that are purposely customized for the nature of Ohlone College MATH-192. Depending on your specific class and goal, varied cooperative learning strategies can be designed in order to improve students’ active engagement in the mathematics classroom.

REFERENCES