

Forms of Energy: Cooperative Learning in the University Classroom

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Abstract. *The present realities and the uncertain future regarding energy sources and use make the subject of educating people on this issue, a subject of paramount importance. If tomorrow's leaders are to be born in today's universities then university classrooms are probably among the best places we can use to prepare ourselves for the challenges ahead. This paper describes the use of cooperative learning activities in teaching and learning about forms of energy. Different ways of using cooperative learning activities are described along with reasons for implementing this type of instructional method. The paper also identifies the barriers that should be overcome in order to ensure success.*

Keywords. Cooperative learning, cooperative learning activities, forms of energy

1. Introduction

What will happen when the world can no longer rely on non-renewable energy sources, especially oil? Are we doing enough to take energy efficiency and conservation in our own hands? What should we do to confront the negative consequences of our excessive reliance on fossil fuels, such as air pollution, destruction of pristine areas, global warming and political and economic instability around the globe? What are the possible alternatives to oil? Can any of them or all combined fill the gap left by

the depletion of oil? Are energy sources easily interchangeable? What are their advantages and limitations? Will scientists be able to think of solutions? How can we expand our alternative energy horizons?

There are no easy answers to such questions. Yet, we need to confront them. And if university students are tomorrow's leaders then the university classroom, along with the necessary techniques of student engagement, is most likely one of the best places to use. This paper attempts to tackle the concerns raised by the above questions by putting forward appropriate cooperative learning activities. Characteristics of good activities are followed by actual examples along with reasons for implementing such activities. The paper also identifies the barriers that should be overcome in order to ensure greater application of such methods in the University classroom.

2. What is cooperative learning?

“Active learning” is anything that students do in a classroom other than merely passively listening to an instructor's lecture. This includes everything from listening practices which help students to absorb what they hear to complex group exercises in which students apply course material to “real life” situations or / and to new problems.

The term “cooperative learning” covers the subset of active learning activities which students do as groups of three or more, rather than alone or in pairs. Cooperative learning is a structured,

systematic instructional strategy in which small groups of students work together toward a common goal.

Cooperative learning is to be distinguished from another now well-defined term of art, “collaborative learning”, which refers to those classroom strategies which have the instructor and the students placed on an equal footing working together in, for example, designing assignments, choosing texts and presenting material to the class.

3. Why Use Cooperative Learning Activities?

Use of cooperative learning techniques in the classroom is vital because of their powerful impact upon students’ learning. Those who employ cooperative learning methods do so with a number of key assumptions in mind:

- Learning in an active mode, e.g. in a small group, is more effective than passively receiving information, e.g. in a lecture setting.
- Participation in small group activities develops higher order thinking skills and enhances the ability to use knowledge.
- Accepting responsibility for learning as an individual and as a member of a group enhances intellectual development.
- Articulating one’s ideas in a small group setting enhances a student’s ability to reflect on his or her own assumptions and thought processes.
- Developing social and team skills through the give-and-take of consensus building is a fundamental part of liberal education.
- Appreciating diversity is essential for the survival of a multicultural democracy.
- Teaching and learning can be a shared experience between teachers and students.
- Teachers may be effective as facilitators of learning. That is, they can promote learning by being a “guide on the side”, rather than a “sage on the stage” [8], [10], [11], [12].

As can be seen from this list, cooperative learning activities offer good opportunities to raise awareness on energy issues and foster the action needed to handle them.

4. Characteristic Features of Good Problems

The characteristic features of good problems are:

- They tell engaging stories in settings to which the students can relate, thus solidifying the eventual connection between theory and application.
- They are open-ended, challenging students to make and justify estimations and assumptions.
- They engender controversy or require decisions, so their solutions require students to demonstrate thinking skills beyond simple knowledge and comprehension.
- They are complex enough for students in each group to recognize the need to work together to succeed in arriving at a satisfactory conclusion [2].

5. Some Cooperative Learning Activities

There are over fifty forms of cooperative learning. Each has its appropriate application depending on the nature of the student population and the type of educational outcome to be fostered. Ultimately, each teacher must decide which of the cooperative-learning techniques to use and the relative amount of total in-class and out-of-class time devoted to cooperative learning [9]. Some examples of cooperative learning activities:

Scenarios. Scenarios are a way of analyzing today’s choices from the point of view of the future. Scenarios are not predictions. Their utility as learning tools has to do with the fact that they help people visualize alternative situations and that they encourage the questioning of often deep convictions as to what is going to happen in the future [5].

The class is divided into groups of 5 or 6. When the groups are assembled they are told to elect a spokesperson who will be prepared to share the findings of the group with the class later on. This person should record the findings of each group.

The class is given the following scenario: A great explosion has occurred in the Middle East and all the known oil reserves have been wiped out there. Existing supplies in other parts of the world are in limited supply and are subject to governmental rationing. How will this situation affect: (a) the types of jobs you will be getting into; (b) relations with family members including parents and grandparents; (c) forms of recreation? [6].

True or False Questionnaire. This activity is especially useful when participants are likely to have major misconceptions about the topic(s). Some examples of such misconceptions: "Alternative energy sources can readily replace oil". "Alternative energy sources can simply be plugged into our present economic system and lifestyle, and things will go on as usual". "Alternative energy sources are environmentally benign". "There are no great problems in switching from one energy source to another" [14].

The teacher prepares a list of statements related to common misconceptions about the selected topic(s), half of which are true and the other half false. Copies of the list are distributed to the students. After students have responded to the questionnaire individually, they are asked to discuss their answers in teams of four or six. When the groups have finished the task the teacher reads the first statement aloud and asks the elected spokespersons from each group to announce their group's decision and provide the necessary justification. If no satisfactory explanation is provided by the spokespersons the teacher provides it. The procedure is repeated with each statement.

Jigsaw Group Projects. In jigsaw projects, each member of a group is asked to complete some discrete part of an assignment; when every member has completed his assigned task, the pieces can

be joined together to form a finished project. For example, after students have been divided into groups each student group could research a different form of power generation i.e., nuclear, fossil fuel, hydroelectric, etc. Then the groups are reformed so that each group has an expert in one form of power generation. They then tackle the difficult problem of how much emphasis should be placed on each method [13].

Panel Discussions. Panel discussions are especially useful when students are asked to give class presentations or reports as a way of including the entire class in the presentation. Student groups are assigned a topic to research and asked to prepare presentations. Each panelist is then expected to make a very short presentation, before the floor is opened to questions from "the audience", which may be assigned various roles. For example, if students are presenting the results of their research into several forms of energy, you might have some of the other students role play as concerned environmentalists, transportation officials, commuters, and so forth [13].

6. Barriers to Cooperative Learning

While the activities described above might seem appealing, they often seem appealing for other instructors or other disciplines – but not for our own. The most common barriers to cooperative learning are the following:

Many instructors feel uncomfortable losing their role of being on center stage, performing in front of appreciative students. In using groups, the teacher's role in class is more in the background, where they may observe, listen, and assist students when needed. They also take the role of questioners, asking members of the groups about their conclusions or solutions to problems, asking them to justify what they did and why [4].

Many teachers feel that if they use cooperative learning they will not be able to cover as much content in their lectures. Time spent in cooperative learning groups is time away from the lecture. Many

instructors feel that they already have too much content to teach in the limited class time available per term [7].

Also, as a result of promotion pressures, many teachers avoid experimenting with their teaching, since any experimentation takes thinking about – thereby taking time away from their research and writing [1]. Regarding assessment of their staff, most universities and colleges tend to place more emphasis in the publication achievements of their faculty and not in their teaching successes.

Another barrier to the use of cooperative learning activities is student resistance. Students may not perceive the value of cooperative learning, they may be used to being told what to learn and how to learn it, they may not want the responsibility for their own learning, they may not appreciate that learning is ongoing, or the students' environment may discourage the adoption of some ways of learning [3].

The above problems can be overcome. Academic administrators can help cooperative learning initiatives by recognizing and rewarding the efforts of those who adopt such methods. Instructors may cover less material through cooperative learning than with lectures, but subjects taught using cooperative learning result in content being learned at a higher level of mastery and being retained longer than it is the case with more traditional teaching methods. Further, the pleasure of watching students actively engage in solving problems is so exciting that it makes the time required for the effort seem like time well spent.

7. Conclusion

This paper highlighted the importance of cooperative learning theory in environmental education through the presentation of selected activities on issues related to different forms of energy. Planning and implementing may actually increase the workload of faculty but the rewards will be enormously satisfying. Through working together to learn conceptual information and master knowledge and skills, students learn more and develop many other skills, such as

learning how to work with one another and how to handle a very important environmental issue. These are, after all, the ultimate aims of good pedagogy.

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