

Students' Misunderstandings about the Energy Conservation Principle: A General View to Studies in Literature

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Abstract: In this study, the contradiction between the cooperative learning which has an important place in science education and relative evaluation system has been tried to be defined. The fixation of the situation which was done with the data obtained from literature also has been supported with a semi-structured interview study made with eighteen science lecturers from Kazim Karabekir Educational Faculty. The qualitative analysis of the obtained data brought out into light that relative evaluation system has negative effects on the interaction among students. Such negativities have a quality that can be an obstacle to the cooperative learning which has an important place in science education. For this reason, it is considered that such a study will be beneficial to researchers who work on science education and education policies and to science teachers.

Key words: Science Education, Cooperative Learning, Relative Evaluation System, Absolute Evaluation System, Competition.

INTRODUCTION

In Relative Evaluation System (RES), the success of a student is appraised with a relational way with the success rates of other students in the class (Keskin and Ertan, 2001). In RES, the potential which the student has individually is not important. The important thing is the place which student takes with regard to other students in the class. According to Johanson (1993), an important consideration in the sole use of relative standards for some is the competitive nature of this approach to grading. The students in Relative Evaluation are in competition with one another for a limited number of grades for each one of the lesson (CTL, 2001). Also, Johnson et al. (1998) state that the relative evaluation approach brings along a dangerous competition for their academic lives. According to Gaikwad (1996), an extensive and inappropriate overuse of competitive and individualistic instructional methods in schools probably is the cause of many difficulties students encounter outside of school.

Cooperative learning is the making use of small groups for instructional aim with the goal of students studying together with the aim of increasing the studies of their own and other students in their groups to a maximum level (Johnson and Johnson, 1994). So, a system as RES which depends basically on the competition of students can bring forth objectionable results in the respect of cooperative learning. Although competition develops the desire for struggling in students, it kills their desire for working cooperatively

with together. However, the rising value in our current education understanding is the student-centered education approach, and cooperative learning has a considerable place in this approach. According to Boud et al. (1999), various form of peer, collaborative or cooperative learning, particularly small group activities, are increasingly used within university courses to assist students meet a variety of learning outcomes. Felder and Brent (1996) state that student-centered instruction is a broad teaching approach that includes substituting active learning for lectures, holding students responsible for their learning, and using self-paced and/or cooperative learning. Researchers and practitioners are searching for ways to promote student learning in and out of the classroom. One approach is to provide students with active and cooperative learning opportunities (Yaeger et al. 1999). Cooperative learning constitutes an important level of active learning in which students are encouraged to think, decide throughout the learning process and are responsible for their own learning. So, active learning strategies such as the problem based learning, project based learning and inquiry based learning which increases output in science education need for cooperative activities (Barrows, 1986; Domin, 1999; Frank et al., 2003). Researches indicate that the use of cooperative learning has the potential to lead to an improvement in students' attitudes towards science (Lazarowitz et al.1994; Baz, 2001; Puacharearn and Fisher, 2004). One of the goals of science education is to prepare a scientifically literate citizen who can solve the daily problems about science like pollution, global

warming, overpopulation and recycling. Cooperative learning is an especially effective method used in solving these problems since it encourages people to explain different respects of views (Nesbit and Rogers, 1997). Thanks to cooperative learning, students have been taken an important step to attain the abilities like sharing their opinions, being respectful to other ideas and analyzing them and in the result of that reaching to beneficial synthesis, systemizing the data and make a decision.

In literature along with studies (Deutsch, 1962; Marzano, 1992; Flowers and Ritz, 1994; Steven and Slavin, 1995; Gaikwad, 1996; Johnson et al. 1998) which evaluating the educational results of cooperative learning and non-cooperative learning, also the studies (Tjosvold et al. 1977; Humphreys et al. 1982; Okebukola, 1986; Conwell et al. 1988; Lazarowitz et al. 1988; Kinney, 1989) which researching effects of cooperative learning on Science education are encountered, too. And in this study, we tried to define the contradiction theoretically between the cooperative learning and RES. In addition to this, for providing a more advanced level of comprehension we designed a semi-structured interview with lecturers of science education at an higher education institution that transited to RES. Cooperative learning method's, which is an important step of active learning, being interrupted because of the contradictions with RES which is preferred for its superiorities in evaluation is a big disadvantage for science education. Consequently, we think that such a study will be beneficial for researchers who are studying on science education and education politics and science teachers.

Cooperative learning in a class evaluating by relative

Since the grades are shown in much more categories in RES, it gives opportunity to unsuccessful students to make groups among themselves. Also being of DD and DC grades allows successful students to pass of their some unsuccessful lessons and so their being awarded. Apart to this, RES involves a big advantage thanks to the equality it brought at the applications to graduate exams and in benefiting of scholarship resources (Keskin ve Ertan, 2001). Each one of the factors like university environment, social surroundings, class environment, the lecturer of the lesson, the questions asked in the exams can effect the grades that students take in the exams. The same student can have a different mark in a different learning environment and in a different lecturer's lesson, and even he can take different marks from the same lecturer's different lesson. The grades given at the final of teaching activities can be effective on students' later education, their gaining scholarship, and even in their having a job. Consequently, the differing occurred in evaluation will prevent to display an equitable attitude in education. Because, a grade of a student in RES is based on his or her relative position in the class, it provides a big facility in the application of teaching activities by removing these difference mentioned above and subjecting

students to an evaluation that they can compare themselves with each other. One of the most important reasons which make relative evaluation system as the most preferred evaluation system is that it makes easier to make a comparison among students in proportion to other systems.

On the contrary of RES, the Absolute Evaluation System (AES) uses a fixed standard in which students' performances are determined according to their own peculiar information, ability, and understanding levels (CTL, 2001). There are two important reasons which make RES disadvantageous despite to its benefits mentioned above according to AES. First; relative evaluation will make your grade lower if you are in a too much successful class. On the other hand, your grade will be higher in class that success rate is low. However in the absolute evaluation state, that kind of a difference among classes is not a question of. The second reason is that absolute evaluation is encouraging to cooperative learning. For example, you provide a friend whom you studied together for the same exam to understand the subject by reminding him a specific point about the subject. And at the end your friend took a higher grade than you. In relative evaluation, in this situation, your grade will decrease since the class average will increase, too. If absolute evaluation were done, your grade would not decrease, so you would not be punished since you helped your friend (CEE, 1999). RES can be an obstacle to the unwanted helping by preventing copy enterprises thanks to the competition idea it gives. But apart to this, it prevents the cooperation based helping of students with each other. When students help each other, they will fall into a disadvantageous position for not only to friends they helped, but also for whole class, even for people whom you will pass to a higher level of education together or you will apply for the same scholarship, or a job together. For this reason, RES in education encourages students for competition instead of working cooperatively.

Class environment, according to interaction among students, can be regulated in three categories as; individualistic, competitive, and cooperative based. (Johnson and Johnson, 1988; Gaikwad 1996). In individualistic class environment, students work independently of each other. To reach the learning goals that expected of them is the only aim for them. While they do not seem willing to do cooperation with others, they also do not need to compete with them. Because, in such an environment, all the students in the class have a chance to reach the expected goals incase studied sufficiently.

Students in competitive class environment, tries to reach the wanted learning goals without the idea of working together cooperatively and helping each other. Students struggle for obtaining the degree which only limited number of students can take at the end of the evaluation. Each student that they left back or could not have reached learning goals will be a plus point for them. Consequently, students abstain from sharing their knowledge with others. In such an environment natural group working, brainstorming and even helping will be very little encountered. Each of the students sees the

other as a rival and perceives their success as their own failure. According to Deutsch (1962), a negative interdependence is question of in competition. Students believe that they can obtain their goal only in the situation that other students experience a failure in reaching their goals.

In cooperative class environment, the learning goals that wanted of students can be reached only if studied with a cooperative method. For this reason, students work in small groups and by helping each other. The work of each student continues until each student of the group reaches the expected learning goals. Consequently, students look their friend's success at reaching the goals as their own success. They do not abstain from sharing the information and skills they have with other members of the group.

According to Marzano (1992), the meaningful use of knowledge through decision making, investigation, inquiry, problem solving and invention are probably done more effectively by a cooperative group than by one person. Much of the scientific discovery has been done by scientist group of people rather than one person. When scientific publications are perused quickly, it will come into light that majority of the scientific research has been done by scientist groups (Johnson and Johnson, 1991). The point that to be reached by science education must be to provide an active learning process in which students are accustomed to behave like a scientist and being student at the center. Students' constructing a cooperative learning environment by studying in groups give a possibility to a student centered teaching structure that modern education system requiring. Certainly individual activities and activities based on competition have an important place in education. But schools' evaluation policies that founded on competition and individuality based learning and not giving possibility to the usage of cooperative learning is wrong. According to Gaikwad (1996), such practices do not adequately prepare students for the kinds of cooperative efforts that will be expected of them in their future work and house lives.

Cooperation is a life skill; nearly every job or social relationship involves cooperating with another individual to accomplish a shared goal (Flowers and Ritz, 1994). Consequently cooperative learning has a disclaiming role for individual outside the educational institutions, too. In cooperation, students working in groups can reach the goal of "learn to learn" which is wanted in active learning on behalf of this method. And they traverse an important distance in the way of solving the problematic situations which they will encounter along their life. According to Miller and Peterson (2003), cooperative learning strategies appear to promise positive effects for students, both with and without disabilities, as reflected in increased academic achievement and improved social attitudes and behavior. The general principle behind cooperative learning is that the students work together as a team to accomplish a common goal, namely that each student learns something of value from the cooperative learning activity.

The experimental researches done in science education put into front the importance of cooperative learning. In the interviews which Conwell et al. (1988) done with students working in cooperative learning groups in science classrooms, they reported that a majority of the students have a high self-esteem. In another research, Humphreys et al. (1982) have been compared cooperative, competitive and individualistic strategies in science classes and determined that students taught with cooperative methods have learned and retained significantly more information than students taught with other methods. In a different experimental study, Okebukola (1986) researched for the effect of cooperative learning to the attitudes of students towards science laboratories. In the result of study, students' attitudes towards science laboratories are high in a considerable way in experiment group which practices cooperative learning. Kinney (1989), who have done a research on students' success on general biology lesson, determined that cooperative learning has an important effect on success level in the result of his study. On the other hand, Tjosvold et al. (1977), in the result of their study, founded that cooperative learning strategies develops students' positive attitudes towards both didactic and inquiry methods of teaching science and students who practiced cooperative learning strategies believed they had learned more from the lesson than did students who practiced competitive learning strategies.

Depending on the basis of comparison of cooperative, competitive and individualistic activities, according to a result of a research that classified studies which were done between the years of 1924-1997, the superiority of cooperative learning has been brought out clearly. The studies mentioned showed that cooperative learning supports much more of students' (18 years old and upper) academic success, social relations among students, and between students and teachers, and self-reliance of students, and their positive attitudes towards subject area and collage in comparison to competitive learning (Johnson et al. 1998). It is clear that competitive learning environment has disadvantages in comparison to cooperative learning environment which is an indispensable of modern education system. But it is also a fact that RES which is used widely today and which has many superior qualities in evaluating students gives support to constitution of competitive learning environment. This situation brings out the existence of a contradiction which is necessary to overcome for a more productive science education process.

Method

In this research, a qualitative research design is used. A semi-structured interview technique has been benefited with the aim of determining the effects of RES on the interaction among students and their importance for the respect of science education.

A total of 18 lecturers in the departments of Physics (3), Chemistry (10), and Biology (5) of Kazim Karabekir Educational Faculty have been attended to study. The teaching experience of the lecturers changes

between 3 and 30 years. While the evaluation system in this faculty had been AES until 2002, from this year, RES has been transited. In the year of 2006, absolute evaluation has been given last graduates and left his place to RES completely. The complete of the lecturers in the sample have given lectures in the classes in which both relative evaluation and absolute evaluation had been applied. Semi-structured interview has been organized around the only one question that "What can you say about what kind of changes have made the RES on the interaction among students?". During the interview, probes in the quality of examining the subjects like "the comparison between absolute evaluation and relative evaluation", "the effects of relative evaluation in the respect of Science education, "students' behaviors in class and out of class", "the preparations of students for exams", and "their attitudes during exams" are used. The data obtained from interviews has been put into a descriptive analysis, and the answers given by lecturers categorized under six headings.

Findings

The categories brought out with the descriptive analysis of the data obtained from interviews and the exemplary explanations of lecturers about these categories are given below. When looked from the respect of interaction among students; the interview data can be categorized under six headings. Generally lecturers mention about the unwillingness in sharing information among students, that a negative competition occurring, and about reaction happening towards successful students, from reluctance to group work, and that increasing of unwanted grouping and decreasing of initiations to easiness and copying.

1. The reluctance to sharing knowledge

Almost entirety of the lecturers combines in the idea that students do not share knowledge with each other. Exemplary expressions are like below:

"....some students ask the questions which they want to ask not in class but outside the class, that is, they want to prevent other students to be aware of this information."

"In former system (AES), the successful ones would definitely help their friends who needed support, can explain subject, solve a problem, and cooperation was occurring but now, it comes to me as if that helping, knowledge sharing became weak. That is, even student know the information, he can abstain from telling it to his friend. Moreover, some students told that they escaped from their friends so that they could not benefit it, and that they hid their projects for not giving a clue, and did not give information. "

"That is we can say that knowledge sharing is extremely low....While studying for the exams, I am giving attention, mostly everybody works individually."

2. Negative competition situation

Many lecturers stated that competition is dominate in learning environment and but this competition is in a harmful level. Exemplary expressions:

"There is an excessive competition in relative evaluation. Is it positive? No! I think that it is negative. There is a tense atmosphere in all classrooms now and the students are worried. That is, friendship among themselves has been weakened. That is, I think that. That is, everybody has being behaved as if they become enemy each other in relative evaluation system."

"We can say that competition has increased in proportion to past. That is, only aim of the student is to take a higher grade than others or to have an average above class average. When the student takes such grade, he or she thinks to be successful. The students have an ambition to take high grade rather than to learning."

3. Reaction towards successful students

Again many lecturers stated that successful students in the class feel under pressure, and they encounter negative reactions by other students. Exemplary expression:

".....The student who gets a high mark is externalized. If he states a different opinion, a suggestion or information, it is valued in a negative way. . . That is, students can try to punish those who take high grades from the respect of social. Inside the class, a threat environment can occur towards successful students. That is, they do not like successful student in general, that is, they do not take among them. Because successful student increases average and others have to much more study and depending on thisThe motivation of studying student becomes hindered by other students. They say "don't take high grades since you increase class average."

"....Apart of this, I can see that remaining of the class are in a critical attitude towards those students, they do things which will humiliate them each time or talking, ummm .. and events like sabotaging the activities which they take in part. That is, we can see that sometimes when groups make presentations, almost all of the students in the class are in behaviors towards spoiling the group work of those students."

4. Reluctance to group work

One part of lecturers mentions that students do not want studying in groups and that a decreasing of their helping and solidarity behaviors. For an example:

"It comes as if the cooperation and solidarity inside the group has been weakened in proportion to past. I can say that it (RES) brings out troubles for the respect of cooperation. Group-working has been decreased; I think that, my observations are that. Because, from now on, the event of hiding knowledge from each other came into being.... This decreased group working willingly or unwillingly. Student gets much more egotist. "

"I think group-work is not possible in this system, because groups are working but they enter the exam individually in the end. In group studies, someone comes and criticizes the group as an instance. Teacher, I am so much studying, but he does not work anytime, both of us take 90 points and my average is decreasing. I am leaving that group. He doesn't say especially as a group, but he later comes and tells that he wants to leave the group and study alone. "

5. Undesirable grouping

Some of the lecturers stated that students did some group constructions that not based on cooperation but came out as a reaction of successful and unsuccessful students' towards each other. As exemplary expression;

"Cooperation exists but not with complete meaning. Students who take high grades are one group, and students who take low grades are another group, they go around together, they are supposedly in an aura of cooperation among their inside."

"I can say that students who are in a good state have a little communication by others in the means of sociality, and they can only have a communication among themselves.

6. The decrease in easiness and copy initiations

Again some lecturers gave opinion in the direction that students show pragmatism by not attending educational activities and benefiting from other students and there is a decreasing in copy initiations. For an example;

"The trade of notes (documents related lesson) in relative system diminished some students' benefiting from others as a parasite."

"Students could be passive in absolute evaluation. That is, even I don't take notes or listen to lesson, I can take them by copying from someone. He would think that I can repeat them and give the lesson but now, living on somebody situation diminished."

"In earlier, students do not much complain of their friends' copying of them, but now, students come and say that their friend has been copied of him. That is, students want to prevent copying activities by themselves. "

"I saw that in exams; so if the student worked hard he sat front so that he would not show his paper. Or he tells obviously that that person did that thing after the exam."

Apart from these categories which were figured out in the respect of interaction among students, some findings which lecturers are in same opinion and mentioned below can be helpful for describing changes in learning environment.

A big majority of lecturers mentions that students' fears about exams have increased. According to them, students' unique goal is to take the necessary grade from the exams. With this aim, they can give up the

performance which is expected of them in group working. As an exemplary expression;

"The students' worry about the exam seems as if increased a little. Earlier, when he took 50 points or had worked for that point would be sufficient for him but now he does not know how much he will work, or how much will be sufficient for him... Students constantly stay in alert for exams. They feel themselves in an obligation of constant studying. "

"I have data-based observation in my hand, for example, I used a project-based learning method and I used assessment with rubric for evaluating group works throughout the process, I looked the results, I found a big correlation between points which I gave to groups and points which groups gave to themselves, and a low correlation between point which group gave to itself and points which members in the group gave to each other. That is, students gave to each other low points. So I can say that relative evaluation prevents the objectivity in students' assessment of their peers. "

Together with this, majority of lecturers point out that successful students do not show expected performances of them during exams. These expressions of lecturers can be shown as an example;

"...During the exam, a student who knows 10 questions does only 5 of them so that class average would not rise..."

"Some students abstain from even responding questions which they know the correctly by thinking their friends, too. He says that my friend lets do such a standard that nobody will remain failed. He says that I won't do a paper of 100 points, if I do 100 points I would be opened the distance, he behaves in that manner so that accumulation would be in medium points."

In general, lecturers are in the opinion that their communication with students be supported with RES. According to them, students prefer to communicate with their teachers more than with each other. The explanations below can be given as an example;

"... so as if it comes to me that an education which is based on communication between student and teacher is supported... From the respect communication this system may have a negative effect. But this does not reflect to teacher-student communication. "

Beside to this, one part of lecturers have the opinion that RES may have big disadvantages for science lesson and but such a negative effect can be diminished by teachers. As an exemplary expression;

" So we can say that competition environment extremely bruises this interaction among students and communication which is compulsory in its modern meaning, when we think about science lesson it spoils the concepts like cooperative learning environment and information sharing and being together and discussing...But of course this partly depend on the person who teach the lesson, that is, if you be in such a manner and attitude during your lesson, if you be in an attitude towards increasing active learning and

cooperation, you can diminish these disadvantages such as not working together or not sharing. So it is partly depend on teacher, I think that only RES should not be seen as sinful....So teacher's attitudes and behaviors, and his understanding about learning and knowledge is important in fact. That is, the disadvantages of this system can be diminished by conscious people. As an instance, if you can put to preliminary position the activities such as discussing, criticizing, positive thinking, doing criticism; students will also adopt them, too."

Conclusion and Discussion

The excessive competition environment which comes with RES results to changing which will affect students' learning in their behaviors. Students who believe that their friends' success results to their failing stay away from cooperative activities. Therefore copy activities experienced during exams has showed a big decrease. Because students think anymore that these events which is not wanted in the respect of education are harmful for themselves either. So this system does not give possibility to students' taking high grades by benefit from their friends. So it can be concluded that this system gives a possibility to a just evaluation. Also because of the competition idea which the system has brought, instead of going to communicate with each other, they prefer much more benefiting of lecturer's guiding and knowledge. In this situation, it creates an effect of increasing the cooperation between lecturer and student.

But apart from these beneficial sides, it is a fact that RES has obvious disadvantages for science education. In a competition environment which students want other's failure rather than accomplishment, group working or knowledge sharing is very little. Students' thinking of each other in a situation of being more than beyond a rival constitutes a tense atmosphere in class and out of class. Especially successful students are affected negatively from this negative atmosphere. These students are being abstracted by students who think that they make difficult their situation, and even they are put under pressure. These students who feel themselves under pressure may go to the way that not showing sufficient performance during the exams. On the other hand, such a structure that occurred in class brings together new grouping with it. The main aim in this groups which successful students did among themselves and unsuccessful students did among themselves as a reaction to each other is not learning with cooperation. These are groups which are mainly closed to outside and not volunteer to sharing knowledge with other groups.

The unique goal for students is being able to take part in foreparts in class success ranging. To be able to take better grades from others is more important rather than learning the subject. We can make such a simile for making the situation better comprehended; let's think the learning process as a race and students as runners. The only thing we want from the runners is to finish the race before the other runners. So it is not important for

them in how much time did they finish the race or how much distance did they take. This type of thinking will direct students to short-term learning and to study activities which based on memorizing which is little lasting in mind.

RES can be looked in a view of an alternative of AES which is believed to have deficiencies in evaluation. But, despite its superiorities in evaluation, its contradictory sides with cooperative learning which has an important place in science education put out the necessity of questioning this system. That being an obstacle of RES to cooperative learning by supporting competitive learning is actually its most obvious example of its being not suitable for modern education system. It can be said that AES also encourages an individual-based education system and so it is inconvenient. But when necessary precautions are taken, this situation which will be an obstacle to cooperative learning can be eliminated with the help of little orientations to be done. Together with this, to direct students who are practiced RES towards cooperative learning despite to everything will require much more effort than this. Lecturers, in a meaning, will encounter the situation of "rowing against the current."

Implications of this study and future researcher

RES is probably the most widespread evaluation system in higher education (CTL, 2001). Because the grades given with RES are valid in many countries, it provides big facilities in international student transfers, graduate, doctorate, and research activities and so in the determination of education policies. Despite its widespread usage in higher education, the disadvantages of relative evaluation in learning environment bring to agenda of a need of alternative evaluation system. In studies which will be done in this area in future, it is necessary that researchers must think hard on this new system. Together with this, other experimental researches are needed which will put out the disadvantages of RES. On the other hand, it is necessary that the researchers of science education must do studies for causing education strategies used in science education to get a format which will be encouraging to cooperative learning and function in harmonious with education institution's general evaluation system. So, we think that such a study will be a beneficial resource for science teachers, education researchers, and those who study in the field of education policy.

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