

# Influence of Cooperative Learning on Students' Self-Perception on Leadership Skills: A Case Study in Science Education

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## Abstract

The aim of this study is to assess the self-perception of pre-service teachers on leadership after getting involved into a Cooperative Learning approach. For that purpose, a pre/post-test has been applied to 57 undergraduate students enrolled in a unit course on Natural and Social Science Education, compulsory in the curriculum of a degree in Primary Education. The inventory of the questionnaire included scales referring to the skills of teamwork, self-understanding, communication, decision making and leadership, regarded as essential for their future professional development. Results show that students perceive higher levels in all of them after a Cooperative Learning experience, which suggests the positive impact of cooperative student-centered teaching strategies to develop such important skills.

**Keywords:** Cooperative Learning, Leadership Skills Inventory (LSI), pre-service teachers, higher education

## 1. Introduction

Lecture is the most common instruction method at the Higher Education level (Biggs, 2005). Basically, it is due to the high student-faculty ratio (normally more than 60 students per classroom), which makes it difficult to use instructional strategies that are more focused on student learning. Traditional lecture encourages individual study but does not promote important competences demanded by society to graduates (Senocak, 2009); those which successfully prepare the student for the labor market (Vardi&Ciccadelli, 2008). Among them there are not only specific, but also generic fields such as leadership, decision making or communication skills.

For these reasons, European institutions have recurrently mentioned that teaching methodologies are one of the main aspects to be improved in the Higher Education System (European Higher Education Institutions, 2001; European University Association, 2003) above others that foster the development of competences rather than the acquisition of isolated knowledge. In this vein, many researchers show a tendency to move into learning methods that imply more student participation in the learning process (Breton, 1999; Peterson, 1997; Ruiz-Gallardo, Valdés &Castaño, 2006; Vardi&Ciccadelli, 2008) and which make them assume their part of the responsibility in the learning process. This changes the role of the traditional lecturer from the knowledge instructor to a guide of the learning process (European Commission, 2001; Ruiz-Gallardo &Castaño, 2008).

In this vein, literature presents a variety of strategies as alternative or complementary to the traditional lecture, but one of the most used is Cooperative Learning (CL). It can be defined as: "students working in mixed-ability groups on clearly defined tasks with the expectation that they will be rewarded on the basis of group success" (Hancock, 2004, p. 160). Research dealing with its application in the classroom is very ample (e. g.: Barret, 2005; Gillies, 2004; Hancock, 2004; Johnson, Maruyama, Johnson, Nelson, &Skon, 1981; Kagan, 1994; Slavin, 1995, 1996; Peterson & Miller, 2004; etc), and the majority of experiences find better outcomes and performance using CL (for example: Barret, 2005; Ruiz-Gallardo et al., 2010), through the action of the student interrogating issues, sharing ideas and clarifying them, and therefore constructing new knowledge (Gillies& Boyle, 2010). But CL has many other advantages (summarizing from Cuseo, 1996): the student becomes more involved in the learning process; and results of higher interaction with their group mates; lower levels of drop-out; greater student responsibility; better individual learning and critical reasoning; higher oral and written communication capability;

greater level of student satisfaction.

Nevertheless, it is also convenient to emphasize that these positive aspects could be modified by some variables of individual personality such as anxiety, peer orientation, shyness, introversion and persistence as has been mentioned in some researches (Hancock, 2004; Kagan, 1994; Webb & Palincsar, 1996).

On the other hand, Cuseo (1996) notes that, being leadership one of the most common learning goals in curricula, no strategies are usually specified to develop this skill. Melendez (1996, in Rutherford, Townsend, Briers, Cummins, & Conrad, 2002) defined leaders as “people of vision, effective communicators and decision makers, and intelligent individuals. They respect and value individuals and their dignity; they are committed to service and to obedience to the unenforceable; they have total honesty and integrity; they are kind and they often see themselves as teachers (p.293)”. This is then a very valuable competence in all professionals, and particularly in teachers, since they are models for their children.

To evaluate students’ self-perception of this skill, the Leadership Skills Inventory (LSI) has been largely used. Originally developed and tested at Iowa State University by Carter (Townsend, 1981), this survey was composed of 99 statements divided into 10 internal scales. However, it was eventually refined to the model we have used, reduced to 21 statements (Townsend & Carter, 1983) concerning different social skills, and embedded into five internal scales: Teamwork, Self-Understanding, Communication, Decision Making and Leadership (Table 1). As can be observed, with the exception of the life-dimensional “self-understanding”, all of them are essential competences recorded in the curriculum of the majority of university degrees. The instrument has been widely used to follow the change of students’ self-perception of leadership skills, in every age range and enrolled in different types of programs (Caudle, 2007; Fleener, 2008; Real, 2006; Rutherford et al., 2002).

Consequently, the goal of this study is to evaluate if a Cooperative Learning instructional approach has influence in the self-perception of pre-service teachers about their leadership skills.

## **2. Method**

### *2.1 Participants*

The experience has been developed in a public Faculty of Education in Southeastern Spain. Participants were 57 pre-service teachers enrolled in a Social and Natural Science Education unit course, during the 5th semester of a 6-semester degree. Their age range covered from 19 to 36, though the modal age was 20. During the academic year 2009-2010, 76 students were involved in an experience, out of which 57 (36 males and 21 females) voluntarily filled in both samples of the inventory.

### *2.2 The Course and the Experience*

Natural and Social Science Education is a unit course included in the third and last year of the degree in Primary Education. It is divided into two parts and developed by a different lecturer each. This experience was applied over Science Education, which is taught two hours a week for 15 weeks in the fall semester.

Topping et al. (2003) show some studies supporting that students’ efficiency is higher when they are trained. For that reason, during the first week, students attended a two-hour workshop on Cooperative Learning, where they basically had to practice about roles and aspects that provide strategies to help team organization and to work more efficiently in group. Students were divided into cooperative groups of four. Groups were self-selected in order to avoid problems of incompatibility of timetables.

Students were asked to solve some cases about Natural Science Education for Primary School pupils. They had to design activities so as to teach scientific concepts, write a report and show this experience to their classmates.

The total number of cases solved by students was four: Hands-on in the classroom, Scientific method and children, Misconceptions of Natural Science in Primary Education, and Organizing fieldtrips. Groups were stable along the course, in order to better develop those collaborative skills (Baumberger-Henry, 2005; Felder & Brent, 1994). Sessions were mainly devoted to explaining different aspects of the problems, to show some examples, address student doubts, as well as peer assessment and group discussion (Smith, Hoersch & Gordon, 1995).

All groups were periodically and individually called by the lecturer for compulsory tutorial. Goals were to assess the running of the group, the adequate allocation and function of roles, the participation of all the members, and the correct development of the proposed assignment. During this time many problems with hitchhikers (Oakley, Felder, Brent & Elhadj, 2004) and other social problems arose which needed to be solved. But there were also doubts and difficulties about the assignments. Students also were encouraged to ask the lecturer for any other doubt in free tutoring time.

Each assignment had a final mark, result of the average of self-, peer- and lecturer marking (Ruiz-Gallardo, Valdés & Moreno, 2012). Marks from all the assignments represent 50% of the student' final mark, and are equal for all members of the group. The remaining 50% comes from a final exam, consisting of practical questions derived from their assignments.

Table 1. Leadership skill inventory

Scale	Item no.	Statement	Cronbach $\alpha$
Teamwork	1	I can cooperate and work in a group	0.81
	2	I get along with people around me	
	4	I believe in dividing the work among group members	
	8	I listen carefully to the opinions of the group members	
	12	I believe that group members are responsible persons	
Self-Understanding	3	I feel responsible for my actions	0.88
	5	I understand myself	
	13	I am sure of my abilities	
	17	I can accept who I am	
	18	I feel responsible for my decisions	
Communication	10	I can lead a discussion	0.87
	14	I am a good listener	
	19	I can give clear directions	
	20	I can follow directions	
Decision Making	7	I consider all choices before making a decision	0.76
	11	I use past experiences in making decisions	
	15	I use information in making decisions	
Leadership	6	I feel comfortable teaching others	0.91
	9	I am respected by others my age	
	10	I can lead a discussion	
	16	I feel comfortable being a group leader	
	19	I can give clear directions	
	21	I can run a meeting	

Description: Scales for each skill evaluated, statements (following the order provided by the Carter's survey). Cronbach's  $\alpha$  obtained for each scale evaluated has also been included.

### 2.3 Data Collection

Acknowledging any ethical consideration, students were informed about the aim of the study, before starting with the first lesson. The participation was volunteer and, in fact, not all the students participated. They also were told that they would be personally informed about their results.

Therefore, during the initial lesson, a survey with the aforementioned Leadership Skill Inventory (LSI) was dispensed to the students. Responses were based on a five-point Likert-type scale. The points associated with each response were: 1=strongly disagree, 2=disagree, 3=undecided, 4=agree and 5=strongly agree. Then, higher punctuation means higher agreement or self perception of the skill. Results from each statement were added for each scale, in order to compare results. Therefore, the scales have different ranges of possible results: Teamwork and Self-Understanding: 5-25, Communication: 4-20, Decision Making: 3-15 and Leadership: 6-30.

The same survey was filled in by the same students during their last class. They also had to include their names,

age and sex, in order to match with their pre-tests. Then, SPSS 19 was used to analyze data and compute statistics.

### 3. Results

The Leadership Skills Inventory offers a high level of reliability (Cronbach's  $\alpha=0.89$ ), a kind of result which could be tagged as consistent with other studies, such as those by Robinson and Zajicek (2005) or Fleener (2008). Regarding to individual scales (see Table 1): the Teamwork, Communication and Leadership subscales of the LSI all have high reliabilities. However, the Decision-Making scale shows moderated reliability (Cronbach's  $\alpha=0.72$ ), although it is higher than those obtained by Rutherford et al. (2002), Thorp, Cummins and Townsend (1998) or Boyd (1991) in their respective studies.

To compare the perception of LSI before and after the experience, all the studies reviewed compute a t-test. Nevertheless, to apply such a test, data have to show a normal distribution (Field, 2009). But, in our case, Kolmogorov-Smirnov test of normality is significantly non-normal ( $p<0.05$ ) for some scales of LSI. Then, Wilcoxon signed rank test was computed to compare paired samples.

As that, Table 2 shows statistical results obtained. Considering internal scales of the inventory (Teamwork, Self-Understanding, Communication, Decision Making and Leadership skills), values pre- and post-test are statistically significant ( $p<0.001$ ) in every scale, which means that students scored significantly differently before and after the experience of CL in Natural Science Education. Comparing with other authors, Thorp et al. (1998) found statistical differences in all scales but in Self-Understanding. Robinson and Zajicek (2005) found statistical difference in two scales (Teamwork, Self-Understanding). In the case of Fleener's (2008) study, she found statistical significance in one scale (Leadership).

But also, considering now the overall LSI (Table 2), this difference is, as well, statistically significant ( $p<0.001$ , Table 2). This coincides with other studies that use structured programs such as Waliczek, Bradley and Zajicek (2001), Robinson (2001, in Fleener, 2008) or Robinson and Zajicek (2005). Studies as Fleener's (2008) found results near to significance ( $p=0.058$ ).

To have an objective and standardized measure of the change produced by the method, and to know how important the change is, the effect size (Cohen, 1992) has been computed (Table 2). Taking into account (following the same author) that, over 0.5, it is considered a large effect, all the scales have, then, a large effect, but particularly the overall LSI, Communication and Leadership scales.

Table 2. Statistics of the sample

Scale	Test variable	N	Mean	SD	Z	P	R
Leadership	Pre-test	57	20.77	3.56	-6.15	0.000	-0.81
	Post-test	57	23.28	3.03			
Teamwork	Pre-test	57	19.58	2.60	-4.39	0.000	-0.58
	Post-test	57	20.78	1.99			
Self-Understanding	Pre-test	57	20.12	3.24	-5.47	0.000	-0.72
	Post-test	57	21.59	2.35			
Communication	Pre-test	57	14.63	2.32	-5.92	0.000	-0.78
	Post-test	57	16.22	1.75			
Decision Making	Pre-test	57	11.00	1.74	-5.78	0.000	-0.76
	Post-test	57	12.58	1.32			
LSI	Pre-test	57	86.10	11.19	-6.43	0.000	-0.85
	Post-test	57	94.47	7.94			

Description: N: number of participants; Mean: mean score obtained for each scale; SD: Standard deviation; Z: z-score (based on negative ranks); p: significance ( $p<0.05$ ); r: effect size.

Finally, it is interesting to highlight which questions have obtained the highest or the lowest differences in post-test vs. pretest scores. In this study, the highest was question nr 6: "I feel comfortable teaching others" (Leadership scale) and the second was the nr 11: "I use past experiences in making decisions" (Decision making

scale). In the inverse position, and the only one with negative value (students feel more confident before than after the experience), is the question nr 12: "I believe that group members are responsible persons" (Teamwork scale).

#### 4. Discussion

Regarding statistical results, it seems that the proposed methodology based on Cooperative Learning has a positive influence on the students' self-perception of their overall leadership skills, but also in all the internal scales included. Several reflections can be inferred from this:

As can be observed in Table 2, *Teamwork* scale is statistically significant, and coinciding with other researches (as for example: Andrew, 1994; Rao, Collins, & DiCarlo, 2002). Teamwork is obviously one of the most worked skills during this CL experience. Certainly, students have to develop the same assignment among all the members. Then, they have to divide tasks and share them, once particular tasks are worked individually. They have to organize themselves in order to have a common document in a deadline.

On the other hand, an important factor of good teamwork is individual responsibility. In our case, a bad mark in an assignment is a bad mark for each individual of the group members. Then, if one of students does not carry out his/her task properly, the assignment will be incomplete and the problem will be for the whole group. This is what Johnson, Johnson and Smith (1998a) call the positive interdependence of the group. But also, other problems may arise that they have to manage solutions by themselves. It is relevant that, although the self-perception of teamwork skill is statistically significant, the magnitude of the change is the lowest of all the studied scales. It may be attributed to this type of problems, since, as referred in results section, question nr 12: "I believe that group members are responsible persons" is the only negative considering scores before and after the experience. Students, even they notice that they are better working in groups after the 4 months (then they have more experience), they seem to trust their mates less than at the beginning.

As can be seen, this experience is a way for students to know each other in a more personal (and professional) way (each one's strengths and weaknesses). Normally, this enhances the integration of the members and their performance as a group (Campion, Medsker & Higgs, 1993). This is very similar to what professionals have to do on-the-job (Cuseo, 1996).

It seems that the experience has increased the *self-understanding* of students. Students feel more responsible for their actions and decisions, sure of their abilities, but also they understand themselves and accept themselves better than before. This coincides with some studies that show how students under CL increase their self-confidence (Baghcheghi, Koohestani & Rezaei 2011; Baumberger-Henry, 2005; Yang & Liu, 2005), self-esteem (Johnson & Johnson, 1986; Slavin, 1995) and reduce shyness (Baghcheghi et al., 2011), that lead to better self-perception. The result is very interesting because these are important factors for student performance and behaviour (Beane & Lipka, 1987; Hoffman, Thomson & Cruz, 2004), but are also related with their future professional performance (Baghcheghi et al., 2011).

Good *communication* skills are essential for a teacher. Certainly, during the majority of their working time, they will be speaking and listening to their pupils. They have to speak clearly in order to make kids understand, learn and be able to follow his/her directions. In fact, students answered questions in a higher voice after the experience. Then, it is good news that students who got involved in this Cooperative learning approach felt that they had improved their communication skills through it as shown with one of the highest size effects (see Table 2). In this vein, scientific literature says that Cooperative Learning can be a first step to avoid speech anxiety, since these smaller groups make students feel more comfortable about these first steps (Cuseo, 1996). CL promotes that students help, assist, support, encourage and praise their peers (Johnson, Johnson & Smith, 1998b). The experience makes them verbalize not only their knowledge about the subject when they teach their classmates, but many other elements, such as conflict solving, asking doubts, answering questions, etc., during this face-to-face interaction. Then, it is clear that it fosters their Communication skills. Then, our results are consistent with those of Baghcheghi et al. (2011) or Baumberger-Henry (2005) found better communication skills in nurses after applying Cooperative Learning. In the case of future teachers, the development of this competence can be described as essential since it is one of their main working tools.

Results also show that students, after the experience, are statistically significantly more confident with their *decision making* skill. In fact, as referred in "Results" section, the question nr 11: "I use past experiences in making decisions" obtains the second highest change pretest vs. posttest. It is remarkable that CL experience had taught the importance of supporting their decisions over their previous knowledge. But also, this leads students to actively relate new information to their own previous knowledge creating meaningful learning (Ausubel, 1963).

The fact is that, as referred by authors such as: Baumberger-Henry (2005), Cuseo (1996) or Felder and Brent (1994), students involved in learning methods as CL with cases to solve have to be constantly constructing ideas, debating them and making decisions. For example, Johnson et al. (1998a) included decision making as one of the five critical elements of the CL. Although studies as Yang and Liu's (2005) found that, under pressure, the most talented students' expertise decision making, in our study case, the majority of students feel that this skill is higher after the CL experience. It also coincides with studies as that by Baumberger-Henri (2005) who found better perception of decision making after CL. In similar vein, Baghcheghi et al. (2011) found greater capacity to follow up problems, thanks to the improvement of this competence. Both studies were developed in nursing students.

Results from *Leadership* scale obtain the highest effect size of individual scales. But as important is the fact that, as referred in the "Results" section, the question nr 6: "I feel comfortable teaching others", has been the one with highest difference pre-posttest. This implies that students have a perception of the highest gain in this essential element in future teachers and that may have contributed to highlight their vocation.

Results are also good because, even though Leadership is one of the most common learning goals in higher studies curricula, no specific strategies are usually stated to develop this skill (Cuseo, 1996). As that, this experience shows that CL may contribute to learn Leadership skills.

The fact is that CL provides students with the opportunity to practice leadership skills (Cotell & Millis, 1992; Cuseo, 1996; Johnson et al., 1998a). Nevertheless, and in the same line as in the former skill, Yang and Liu (2005) found that in situations of pressure, the most talented students take the leading role, letting the less talented assume less important tasks and order taking. However, our results are in the line of Graham and Partlow (2004) applying Cooperative Learning in nurse training.

Finally, taking into account the overall *Leadership Skills Inventory*, it shows the maximum differences pre/post-test, but also the highest size effect ( $r=-0.85$ ). Results agree with those studies noting that CL fosters students' to learn social skills (Andrew, 1994; Cuseo, 1996; Johnson et al., 1998a, b; Rao et al., 2002; etc). The way that groups are organized leads to the rising of the basic elements: positive interdependence, face-to-face interaction, group feedback, individual accountability and self and group analysis (Johnson et al., 1998a), seemingly leads students to feel more confident not only with the scales of the inventory, but also those with those of the overall Leadership Inventory.

## 5. Conclusions

This study comes to support others that say that Cooperative Learning is a way of not only learning contents, but also training students in many skills required by any future professional that gets graduated. It shows evidence of how students perceive highly better all the skills evaluated in the inventory: Teamwork, Self-Understanding, Communication, Decisions Making and Leadership skills. This teaches us that the use of Cooperative Learning in classroom, in this case, in Natural Science Education, may increase these important skills perception of students.

Nevertheless, this study has some important limitations, which may lead to further study. Firstly, it has not been contrasted with a control group. It would be interesting to find out if students would have shown similar or different self-perception values than those now obtained, had they used the same inventory under a traditional lecture unit course. Finally, in order to ensure students' perceptions reliability, it would be convenient to compare them with their evaluation throughout the semester.

Changes in the XXI century university are in search of academic approaches to respond to the demands of the labor market. Seemingly, the traditional lecture, where the student is passive and receives all the knowledge already prepared, should change to other models where an active role is required from the student, and where they could really be successfully trained to make decisions, to work in groups or to act as either leader or workers, depending on the moment.

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