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Cooperative learning in the classroom: an experimental study

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Abstract

Results of two experiments are shown in the paper. Following the jigsaw method developed by Elliot Aronson, the experiments were carried out in order to demonstrate the social psychological benefits of cooperation in the classroom. Based on the theories of cooperation of evolutionary biology and social psychology, as a result of the cooperative practices in the classroom, we have expected the development of positive social skills among the experimental subjects. These expectations, however, have been fulfilled only under specific circumstances. Eighth-grade students were not inclined to cooperate and biology as a subject as presented in the designated textbook was not found adequate for cooperative learning. The jigsaw method of cooperative teaching was found efficient in the case of younger (non-adolescent) students when learning discursive subjects such as literature and history.

Keywords: Cooperation, Learning, Social Skills

Riassunto. *Cooperative Learning in classe: uno studio empirico*

In questo lavoro sono esposti i risultati di due ricerche realizzate applicando il modello sviluppato da Elliot Aronson, gli esperimenti sono stati condotti per dimostrare i benefici socio-psicologici della cooperazione in classe. Basandoci sulle teorie della cooperazione tra biologia evolutiva e psicologia sociale, come risultato delle pratiche di cooperazione in aula abbiamo immaginato lo sviluppo di abilità sociali positive tra le materie sperimentali. Queste aspettative, tuttavia, sono state soddisfatte solo in circostanze specifiche. Gli studenti dell'ottavo anno, ad esempio, non erano propensi a cooperare e la biologia, esposta nel testo designato, non è risultata essere adeguata per l'apprendimento cooperativo. Ne consegue che il metodo di insegnamento cooperativo del puzzle di Elliot Aronson è risultato efficace per gli studenti più giovani nell'apprendimento di materie discorsive come la letteratura e la storia., meno per gli studenti più maturi.

Parole chiave: cooperazione, apprendimento, abilità sociali

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1. Introduction

Many regard humans as super-cooperators, given the fact that we can cooperate in large numbers even if we are genetically unrelated. Others would cite against this view the ugliest phenomena of corruption and war. Which picture is more adequate? Neither: during our 5 million years of evolution (after we got separated from the apes) both types of behaviour had their function.

Our cooperative behaviour is rooted in genetic evolution but stretches well into the realm of cultural evolution. In order to understand our *cooperative phenotype* neither sources should be neglected. Trying to understand the human condition without its biological foundations is like trying to do biology without chemistry: whereas some success is possible, comprehensive understanding is ruled out. Chemistry helps us understand the mechanistic details of some key biological processes (e.g. how DNA replication serves heredity) and it sets certain constraints on what is possible and what is not. Physics sets also some fundamental constraints: in contrast to flight, levitation could not evolve, however clever evolution by natural selection is. By the same token, no social theory can be successful today that ignores biological constraints. Let us emphasize: social life and cultural evolution are more than biology, but they rest on biology. The latter does not determine, but limits possibilities for the former.

We hear from all corners today that we are living in an age of complexity, the understanding of which is not fully supported by our evolutionarily originated and inherited cognitive capacities. This is true but the same phenomenon made life for, say «Homo erectus» difficult. What is simple for us after millions of years of evolution was complex for them. The snag is that our new world is not only complex (again) but it is also changing fast, not to be tracked adequately by genetic evolution. Whether cultural evolution will be able to cope with it remains to be seen.

We call attention to the fact that the phenomenon of cooperation is as old as evolution itself. The so-called major transitions in evolution have always brought with them some new kind of cooperation (Maynard Smith and Szathmáry, 1995): without the latter, Darwin's principles of multiplication, inheritance and variability, combined with hereditary effects on fitness automatically lead to competition. (Fitness is the expected number of offspring.) Cooperation in evolutionary biology by definition involves fitness costs to a donor (altruist) when it helps a recipient. If so, how is cooperation possible at all? Ever since Darwin, biologists have been puzzled by this question. By now, a set of interesting candidate answers have been found.

Although this paper is not about the evolution of cooperation, we must give the necessary

background to see what kind of evolutionarily given behaviours our cooperative experiments might be rooted in.

Perhaps the best-known explanation for cooperation in biology is kin selection (Hamilton, 1964a and 1964b): it can easily pay off to help your relatives (Darwin had the idea that in such cases the family, rather than the individual is the unit of selection). Hamilton found a simple rule for this: the famous inequality b r > c, where *b* is the benefit to the recipient given by the donor, *r* is the degree of relatedness between them and *c* is the cost paid by the helper. *b* and *c* are of course measured in terms of fitness. Although Hamilton's rule does not simply and always hold (De Vladar and Szathmáry, 2017), it remains true that genetic relatedness is often important for biological cooperation. It must have played a role in our past, and it is effective in certain contexts even today (e.g. nepotism). But as we have said before, human cooperation is special, since genetic relatedness is often not required for it to work.

So what are the mechanisms other than kin selection that could explain human cooperation? We briefly discuss these mechanisms (Rand and Nowak, 2013) below, but first, a remark is in order. We are past the stage of mere theorizing: laboratory experiments and comparative investigations abound that aim to test this or that hypothesis, often with surprisingly convincing results. It is not our aim to review those studies here, but it is important to note that they exist.

Direct reciprocity. These investigations often start from the famous Prisoners' Dilemma situation. There are two players, either of whom may cooperate or defect. Cooperation is costly, defection always pays in a one-shot game, but mutual cooperation would result in the highest total gain. However, cooperation can emerge even in this situation, if encounters with the same persons occur repeatedly. More technically, the probability of continuation (the «shadow of the future») should be above a certain threshold. There are two strategies that do especially well in such games: tit for tat (TFT: cooperate on the first move, then do whatever the partner did in the previous round) and Generous TFT (allow for a few mistakes of defection by the partner).

Public goods game. Depending on the details, this game can be a case of a generalized

Prisoners' Dilemma with n players who can contribute to the common pool of resources. Contributions are multiplied by k(< n), then evenly distributed among the players. In this basic situation, cooperation breaks down since the game will be dominated by defectors. There are three ways out: either k should depend on the number of cooperators who actually donated, or defectors should be punished. The third option is multilevel selection, to be discussed below.

Indirect reciprocity. Here there are pairwise interactions but randomly chosen from a pool of *n* players. Crucial is that third parties can watch the interactions and they can memorize who cooperated and who did not. The corresponding "scores" are noted and can spread as reputation in the population. Memory size naturally limits the size of the group in which cooperation can spread.

Structured selection. In this case, individuals do not assort randomly for interaction, as in the «well-stirred» case. Instead, they have a number of neighbours with whom they can interact. Typically, when the web of interactions is fixed, cooperation cannot get established. Dynamic restructuring, resulting from choice by individuals with whom they wish to interact most, can stabilize cooperation.

Multilevel selection. Many would know this mechanism under the name of group selection. Here not only individuals but groups formed from them compete with each other. In Darwin's (1871) words: «There can be no doubt that a tribe including many members who were always ready to give aid to each other and to sacrifice themselves for the common good, would be victorious over other tribes; and this would be natural selection» – i.e., selection among tribe (groups). This mechanism works: for example, it maintains a high level of cooperation in the public goods game. There are strict conditions: group size cannot be too large, and migration between groups must be limited. Rocking the common boat is not a good idea unless you can hop from boat to boat.

Real situations are of course more complex. This can be illustrated by the (somewhat depressing) account of the coevolution of parochial altruism and war (Choi and Bowles, 2007). This is a simulation model that is the beginning rather than the end of a necessary series of investigations. The authors envisage a population of groups. In each group, there

are a few dozen individuals. There are two pairs of possible strategies: «altruist and tolerant», and «parochial and non-parochial». It is assumed that these are transmitted genetically. The authors do not claim that this is necessarily the case: they want to find out what happens if these assumptions hold. Whether they hold is an empirical question, warranting further investigation.

Altruists contribute to the public good in each group. Non-parochial altruists may help members of other groups also. Parochial individuals show hostility to members of other groups, but only parochial altruists engage in actual combat with the risk of death. Within each group, tolerant non-altruists are favoured (as free-riders on the public good). Intergroup combats favour the spread of parochial altruists through the process of group selection (loser groups go extinct). When war is on, combat is likely if in at least one group the number of parochials is sufficiently high. In that case the group with the higher number of parochials has a higher chance of winning. Combat is costly in terms of death, and the loser group is subject to further massacre. The winners populate the habitat of the losers. The stunning result is that despite all costs involved, parochial altruism can spread in the population.

We note that before the advent of agriculture, there is ample evidence for intergroup hostility among hunter-gatherers for over a hundred thousand years. It is thus not excluded that we have some genetic predisposition to the combination of altruism and parochial hostility, but even in this case polymorphism is expected.

This brings us to the question of the genetics of human social traits. Should there be no genetic variation for social traits, genetic evolution is unlikely to have played a crucial role, and in this case, cultural evolution remains the only player. But there is genetic variation. Setting the discussion of methodological difficulties aside, fishing for social genes rests on the study of mono- and dizygotic tweens (Ebstein *et al.*, 2010). Investigations partition the observed variation in traits into three bins: variation due to shared genes, shared environment, and unshared environments. To put it simply, there is some genetic variation for all traits analyzed, but the weight of genetic influence varies from trait to trait. Prosocial traits, social responsiveness and empathy have rather high heritability. Interestingly, several items related to the laboratory analysis of cooperative behaviour (in the Dictator and Trust

games*)* have significant, but rather low heritability.

We briefly touch on the issue how cooperation relates to other outstanding human adaptations such as natural language. It now seems that cooperation and language had a significant period of synergistic coevolution, beginning with the time of *Homo erectus* around two million years ago (Bickerton, 2009). As in several cases of radical evolutionary change, it was likely to have been triggered by an increasing shortage of food (i.e. fruits). The meat of prime game was lying around in the form of huge, fresh carcasses. It can be convincingly argued that the emerging habit of confrontational scavenging required protolanguage and strict cooperation. Confrontational, because big predators also like to feed on carcasses. Scavenging, because weapons of the time were good for butchering but not for killing big animals. Protolanguage, because it was important to communicate with the tribe about things NOT here and now (i.e. distant carcasses – linguists call it displacement). Cooperation, because fighting against hungry predators, butchering, and carrying meat were demanding jobs.

How do the above (genetic and cultural) evolutionary mechanisms relate to our experiment? It is not direct reciprocity, because interactions are not pair-wise. Pupils interact in groups throughout the experiment. Past experience (reputation) may play a role in to what extent pupils are ready to teach someone. They contribute to common knowledge, but sharing knowledge is different from sharing money: if I pass on information to you I do not lose it by the act of giving (Lachmann, Sella and Jablonka, 2000). The only possibility of cheating is to withhold information or spread disinformation when the experts join the learning groups in the second phase. But because pupils are members of an established community, fear of punishment is likely to deter such spiteful behaviour. A simple modification of the experiment would turn it into an exercise into cultural group selection. Suppose that for marking, one individual from each group would be drawn randomly, but all members of her or his group would share this mark. This would presumably enhance the group effect, as we plan to try this method in future experiments.

A crucial component of our experiments is the division of labour. What kin selection theory explains well is reproductive division of labour in that there are more and less fertile

individuals in animal societies, up to the point that there are non-reproductive castes. But there can be further division of labour among the non-reproductives, just as our bodies harbour hundreds of cell types that do not make it to the next generation (they all they). Evolutionary biologist have realized that such division of labour can be understood, following the economic reasoning of Adam Smith (2003) by an increased dexterity from cooperation among specialists. Biological examples abound (Maynard Smith and Szathmáry, 1995). A necessary condition for the success of the division of labour is the tradeoff between tasks, commonly expressed as («a jack of all trades is a master of none») Note that this mechanism can work through individual benefits if the "market" is sufficiently large.

What is the essence of cooperation? Following Kurt Lewin, his former student Morton Deutsch states that the cooperative situation is in which «the goals of the participants are so linked that any participant can attain his goal if, and only if, the others with whom he is linked can attain their goals» (Deutsch, 1973, p. 20). Note that this formulation is stricter than that usually adopted by evolutionary biologists, but it fits the confrontational scavenging scenario well.

To put it in other words, in cooperation there is a linkage of goals of all participants. No one in the social interaction can abstain from the promotive interdependence. In real life, there is no pure form of cooperation. It might well happen that the same persons in some situations are in promotive interdependence with others while in other situations the interdependence is of the opposite direction, namely, contrient. The members of a research unit may be cooperatively interrelated with respect to winning a grant together but competitive with respect to becoming a Nobel-prize winner.

Our aim is to study the social psychological effects of cooperation in the classroom by the experimental method. The reason why we focus on cooperation is that in cooperative situations, if the actors behave in such a way as to increase their chances of satisfaction by goal attainment, they also simultaneously increase the chances that the other members of the group with whom they are positively interlinked will also attain their goals. This process of mutual aid has an evolutionary added value as opposed to competition where the chances of

the actors to attain their goals are severely limited by constraints set by the nature of content interdependence. Cooperation has become a priority issue in Europe as the new Skills Agenda for Europe, adopted by the Commission on 10 June has demonstrated launching 10 actions to make the right training, skills and support to be made available to the people in the EU.

In a wider context, human cooperation is special, in that humans can cooperate even in large non-kin groups. This is an evolutionary heritage (Maynard Smith and Szathmáry, 1995), together with the ability to master natural language. Especially in the human context, there are some notable effects of cooperation. We discuss them in turn:

Substitutability. In competition, actors waste their energies. In cooperation, due to the division of labour, actors do not need to duplicate each other's activities. Superfluous activities have no room to emerge.

Positive cathexis. In a cooperative situation, there is a high possibility that Actor1 will cathect positively Actor2's actions. Moreover, Actor2 will reverse the positive cathexis unleashing benevolent social processes resulting in trust, empathy, tolerance and understanding. In competition, because of the emergence of negative cathexis, the development of malignant social processes will be likely.

Inducibility. In order to attain the common goals in cooperative situations, people will be mutually helpful and responsive to each other's needs and demands. Competitors, on the other hand, will more likely want to hinder and set obstacles to each other. To sum up, cooperative processes permit a more economical use of the human resources leading to enhanced task productivity. The major effect of cooperation is the development of trust, openness and social flexibility. Lesser psychological costs can be expected. Experiencing the positive effects in the classroom will likely to lead to a more successful career in later life.

Shared intentionality. In contrast to cooperation in most animal species, humans have a capacity of shared intentionality that enhances the complexity and efficacy of cooperation (Tomasello and Carpenter, 2007). Although by the age of the pupils this capacity is basically given in them, we can expect that this capacity will be enhanced due to training in the

cooperative jigsaw task.

Dangers. There is, however, the danger that because of the division of labour actors will have vested interests in their specialized functions, so they may become more oriented towards the fulfillment of their own role expectations and functions than to the attainment of the overall fulfillment of the group goal. The development of friendly relations within the group can lead to "group ethnocentrism" and sectarianism as well as super conformity. Inhibition of conflict and competition can result in retarding innovation. The preponderance of friendly relations within the group can set back productivity and enhance favoritism or nepotism, repression of inner conflicts that normally serve for evolution.

A further danger (which is as old as hereditary replicators are) is the appearance and action of free-riders who take the advantages of cooperation without cooperating themselves. In the proposed experimental setup this type of behaviour can be easily identified by the actors and the cheaters may suffer from various forms of punishment by the cooperators.

2. Materials and Methods

2.1. The Cooperative Learning Environment

Cooperative learning involves students working together in small groups. According to our expected results, cooperation in the classroom leads to better success rates and enhances the development of social skills such as conflict management, tolerance and empathy. Moreover, cooperation improves self-esteem, promotes socialization and personality development. When students are together in a cooperative setting they learn to listen to what others have to say, share ideas and perspectives. They give and receive help. The teaching process is reciprocal, the roles of the tutors and students alternate.

2.2. Creating a cooperative learning environment

Students alternate between tutor and tutee roles. They should understand how they are to work together, to contribute, to accept. They learn to take responsibility for completing their part of the task, and assist each other's learning in an environment that is supportive of its members. The students have to understand that they will be expected to play a more active role. They search information themselves. The basis for cooperation is trust and understanding.

It is important to mix students. The selection of students into groups should be conscious. They should be mixed according to ability, gender and sociometric status. Students must be explicitly taught the skills needed to the successful dialogue together. They will take part in collaborative strategic reading. In the groups, they learn to ask questions from each other as well as they learn to give answers.

The major task in the cooperative learning system is to bridge the achievement gap between disadvantaged students and their more advantaged peers. The cooperative learning system has significant gains including reading vocabulary, reading comprehension and mathematics computation.

Even disabled children obtained better results in the cooperative learning system compared to the traditional schools. Because of peer coaching, gifted children benefitted too.

2.2.1. Skills

The opportunities of developing social skills are there in the cooperative learning environment. In cooperation, students actively listen to each other, they state their ideas freely, including providing constructive criticism. Cooperation created an environment compelling participants to communicate accurately. Conflicts can be resolved by taking superimposed goals made accessible through communication leading to mutual acceptance

and support (Sherif, 1958).

How long should students work in cooperative groups? According to Tuckmann (1965) in order to emerge the benefits of cooperation, the students have to work 4-6 weeks. Subjects, however, differ from each other. Not all subjects can be taught by using the cooperative method. In our experiment students have taken part in the collaborative classes through two months, meeting once a week.

2.2.2. Teachers' role

The teachers play the role of *mediator* in the cooperative learning environment. They are responsible for coaching and facilitating the cooperative processes. There is no need any more to command the students. Discussion of the students should be encouraged. The teachers in the cooperative environment are working with the students. The teachers *do not tell* students what to do. Instead, they behave as equals in the classroom. In order to enhance the level of learning the teachers have to provide the students with multi-sourced curriculum material. The first duty of teachers is to teach students to ask questions.

Teachers in cooperative learning setting are to help students to understand that they will be expected to work together and this includes sharing ideas, facilitating each other's learning, the resolution of conflicts.

2.2.3. Evaluation

In assessing small-group learning, the principles of summative assessment and individual accountability contradict. Criterion-referenced assessments are preferred. There are, however, difficulties with evaluation of the individual performances. Gifted and talented members of the groups will be motivated if they recognize their responsibility in the summative assessment. Evaluation should be followed by a discussion with students.

2.3. The jigsaw method

In order to explore the uses of cooperation in classroom teaching, we opted for the experimental method developed by Blaney, Stephan, Rosenfield, Aronson, and Sikes in 1977. (Aronson *et al.*, 1978). Originally, the project was designed by Elliot Aronson to weaken intergroup competition in forcibly integrated schools. In contrast, here we set out to measure the effects of cooperation in an educational environment consisting of students coming from homogeneous social and ethnic background.

The jigsaw technique is a method of organizing classroom activity that makes students dependent on each other to succeed. It breaks classes into groups and breaks assignments into pieces that the group assembles to complete the "jigsaw", puzzle.

The jigsaw technique creates the ideal social setting for cooperation. The class is broken into groups and the lesson will be broken into pieces. In each group, members of the group will have to specialize in one of the pieces of the given lesson. The members of the group work individually, learning the piece assigned to them. Next, they present what they have learned to the other members of the group. This makes possible for the members of the topic group to embed their knowledge and synthesize information. They write a report of their assignment. At the end of the class, the original groups come together again and members of the groups listen to the presentations of their fellow group members. "Experts" train other "experts" till every member knows the lesson in its entirety. Each student in each group educates everybody in the group about the topic. Students were later questioned on what they have learned about the assigned topic.

Two experiments were carried out in one of the educational institutions in Kőszeg at Árpád-házi Szent Margit Óvoda, Általános Iskola és Gimnázium among eighth-grade students. It started in March and ended in May of 2017. The subject taught was biology, supervised by Eörs Szathmáry, in agreement with the biology teacher. Classes were held between February 21 and May 22, every second week. The second experiment was carried out on a weekly basis between September 3 and December 21 in 2017. The subjects were history and literature. The second experiment was carried out among sixth-grade students.

(See the description of the methodology in the Appendix).

2.4. Independent variable

The subjects were taught in two classes. In one class (Control group) , the subjects were taught by the traditional method. In the second class (Experimental group), the subjects were taught by the jigsaw method.

2.5. Dependent variable

2.5.1. Empathy

Empathy was tested before and after the experiment in both classes. The test applied consisted of six empathy factors. (Mayer, Salovey and Caruso, 2008).

2.5.2. Positive thinking

Positive thinking was measured with a short questionnaire developed by Márta Fülöp (2009).

2.5.3. Social Trust

Social trust was measured with the questions of trust used in the European Social Survey (ESS).

2.5.4. Cooperative communication

Based on Grice's maxims of cooperative communication four statements were formulated. Readiness to cooperative communication was measured by Likert scales separately in case of the four statements.

3. Hypothesis

We expect that, as a consequence of the cooperative learning method in the jigsaw class compared with the traditional class, a significant increase will be found in empathy, positive thinking and social trust. We do not expect, however, increase in the level of achievement.

4. Results

4.1. Experiment 1 (2017)

Results are summarized in Table 1. The level of empathy was found to be higher in both groups after treatment but the difference was found more marked in the control group. As to the comparison of the means before and after the treatment, the means of the experimental group did not show a significant change, while in the control group the comparison showed some deterioration. As to the comparison of the means of positivity before and after treatment, there was not any significant effect found between the experimental and the control groups.The level of trust changed as a result of the experimental treatment.

The treatment proved to be successful for cooperative communication. Members of the experimental groups were more prone to cooperative communication, compared with the members of the control group.

	Exp. Group	Sig. (2- tailed) /t	Control group	Sig. (2- tailed) /t
Empathy	0,0366	0,748/ 326	0,100	0,352/ 0,854
Positivity	-0,053	0,719/ -0,364	-0,031	0,883/ -0.149
Trust	0,222	0,673/ 431	-0,15	0,820/ -0.231
Cooperative communication	-0,006	0,968/ -0,041	0,11	0,371/ 0,9

Tab.1. Difference between the means of the experimental and control groups before and after treatment (Experiment 1)

4.1.1. Focus group discussion

The students were surprised by the experimental design that forced them to cooperate. They responded selectively. Some of them were fond of the new design but quite a few resisted. The teacher was first afraid to lose her power and authority, but later she realized the benefits of the design. The major obstacle was the structure of the subject: the biology textbook written for 14-year-old schoolchildren gives just a list of the topics to be taught but the authors of the book apparently did not want to raise problems and they did not intend to connect biology with real life. The history textbook was not more than a newspaper written years after the events. No interpretation, no explanation, no generalization. Conspicuously enough, no attempt was made to include ICT in the learning process. The cooperative learning method cannot be effective without the profound change of the learning environment, including the content. Cooperation, team building and project driven learning go in hand in hand.

4.2. Experiment 2 (2017)

Eighth-grade students seemingly were not very much enthusiastic being involved in cooperation with each other in the classroom. Their diverse interests prevailed over interdependence, presumably because of growing adolescent behaviour. As a consequence, we decided to redo the experiment with younger students. We changed the subject as well. Instead of teaching biology, history and Hungarian literature were selected.

Experiment 2 has confirmed the hypothesis in two dimensions. Table 2 shows that significant difference was found in positivity between the experimental and the control groups. Significant difference was found in the dimension of cooperative communication. In the dimension of trust, a slight significant difference was found. In the case of empathy, a reverse effect was found in both groups, but the difference between the two groups was not significant.

To sum up: in the dimensions of positivity and cooperative communication, cooperation in the classroom resulted in a significant difference between the experimental and control groups. As a result of the cooperative learning environment, students have become more positive in their worldview and more open to each other. The levels of trust and empathy did not improve.No difference was found in the level of achievement. Grades of the students on the average have not shown significant difference between the experimental and control groups.

	Exp. Group	Sig. (2- tailed) /t	Control group	Sig. (2- tailed) /t
Empathy	-49.32.00	0.850/ -0.192	-0.196	0.093/ -1.785
Positivity	0.7965	0.000/6.33	0.575	0.000/5.335
Trust	3.058	0.000/7.780	3.345	0.000/7.644
Cooperative communication	0.1850	0.237/1.222	0.131	0.365/0.933

Tab.2. Difference between the means of the experimental and control groups before and after treatment (Experiment 2)

4.2.1. Focus group discussion

At the end of the second experimental round, on December 17th, 2017, a focus group research was carried out among the experimental subjects. The first question to be discussed was about the comparison of the jigsaw method and the traditional method of teaching. The members of the group agreed with the statement that learning was much easier in the course of the joint work. According to the general view, cooperation increased the level of friendliness, mutual aid and made it easier to discuss the learning material. All of them were satisfied with the outcome of the cooperative learning experiment that facilitated the learning process, including the exchange of ideas and recalling the lessons. They were aware of the change of the role of the teacher, who had taken the roles of advisor and organizer instead of being a supreme authority.

5. Summary and Discussion

The first cooperative learning experience resulted in a slightly positive change in the experimental group compared to that of the control group. Members of the experimental group, as a result of the treatment, showed a greater readiness to cooperative communication, but in the level of empathy, trust and positivity, there were no significant effects. The level of academic performance was not affected either.

The lack of the expected results in the first experiment can be attributed to the characteristics of the subjects, such as age and school career. Being 8th grade students, all of them were looking forward to going on to various institutions in and out of Kőszeg where they could continue their education career. Consequently, the level of cohesion and the readiness to cooperate was decreased. This finding is consonant with a reduced “shadow of the future” effect, as it is seen in the PD game. Moreover, there were only 8 instances of cooperation that certainly were not enough to induce the expected effects in cooperation. Finally, the given rendering of biology as a subject seemed unsuitable for the realization of

cooperative learning experience since the learning objects resisted to discussion and independent thinking.

We had more promising results from the repeated experiment among 7th-graders in literature and history. These subjects were more apt to open discussion and communication. Moreover, the experimental classes were organized on a weekly basis, increasing the intensity of the exposure to the cooperative learning environment.

Cooperation has been around since life began: without it, not only we, but even bacteria would not be here. Arguably, the Homo genus owes its striking evolutionary rise to the combined effects of super-cooperation and natural language. If we as a species are to survive then we should cooperate not less but more. For example, the threats posed by, say, climate change or emerging diseases will be solved by global cooperation or not at all.

In the near future we plan to identify even better dependent variables but also improve on the experimental setup to bring it closer to a group-selection scenario. We are aware of the fact there are likely to be significant societal benefits if our research program is carried out with success in full.

ICT (info communication technology) has a crucial role in establishing a cooperative learning experiment. ICT makes communication possible with anybody, anytime, anywhere and about anything (Castells, 2009). Collaboration in the cyberspace can transcend boundaries. ICT brings many potential benefits to education. Network technologies open new vistas for collaborative education, broadening the time and space dimensions of teaching and learning. Students and teachers will have to learn to collaborate and to collaborate to learn as well. Technologies, however, have not reached maturity to become easy to use in classrooms but teachers must be aware of the learning potential of multiplying intelligence through synchronous and asynchronous collaborative methods offered by ICT technologies (Chan, 2003).

Cooperation is important not only globally but also locally, including small communities and nations. Hungarian, for examples, are not the best cooperators, yet relative national success would critically depend on cooperation, including the ability to identify win-win situations.

We maintain that social cooperation can be improved, and one of the ways is to learn how to cooperate (better). The recognition of this effect is behind our project described in the present paper. The results are encouraging, and there is also rising interest on behalf of the teachers of the school where our experiments were conducted.

Reports on the social psychological landscape of the Hungarian society are rampant with evidence of distrust, anxiety, and lack of solidarity (Tóth 2009; Csepeli, Örkény and Székelyi, 2004). According to the diagnoses of the eminent Hungarian sociologist Elemér Hankiss, the individuals living in the Hungarian society have no collective perspectives, instead, they are prone to be involved in social traps (Hankiss, 1985). We believe that the only remedy for this social pathology is cooperative education. Cooperation in society, however, cannot be conceived without cooperation in everyday life. The results of our experiment will hopefully contribute to the spread of the culture of cooperation in Hungarian schools.

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Appendix

Questionnaire measuring empathy, positive thinking, social trust and readiness to cooperative communication.

1. Empathy

Rate please the following statements according to the degree of agreement.
(5- strongly agree, 4 -agree, 3- nether, nor, 3 disagree, 1 strongly disagree)

E.7.Suffering of other people is disturbing to me

E.8.I am outraged seeing violence against children

E.9.Too much fuss is made about suffering of animals

E.10.I am very much bothered seeing hurting other people

E.11.If persons are laughing around me I tend to laugh also

E.12.I am outraged experiencing injustice done against other people

E.13.I do not notice if people around me are taking care of each other

E.14.It makes me happy if I see that people around me are happy

E.15. I am easily involved in other people's emotions

E.16. My emotions I do not share with others and I am not interested in other peoples' emotions

E.17. The excited masses make me excited too

E.18. It is a good feeling to help other people

E.19.I deeply feel what other people feel

E.20. I weep rarely

E.21. I feel other peoples' sufferings

E.22.It other people smile I smile too

E.23.I am happy surrounded by happy people

E.24. Whenever I see suffering children in the TV I am disturbed

E.25.At sad part of books I used to weep

E.26. It makes me sad if I a am surrounded by unhappy people

E.27. I cannot stand if someone is weeping in front of me

E.28.I am disturbed by experiencing other peoples' pain

E.29.I feel love to people who help others

E.30. I deeply share others' happiness

2. Positive thinking

Rate please the following statements according to the degree of agreement.
(5- strongly agree, 4 -agree, 3- nether, nor, 3 disagree, 1 strongly disagree)

1- I trust in the future
2- I am satisfied with my life
3- Generally I can expect support of other people
4- I hope that the future brings good
5- Generally I am very much satisfied with myself
6- Sometimes I feel embarrassed concerning the future
7- I feel that there are many things I can be proud of
8- Generally I am confident of myself

3. Social trust

What would you say?

Generally speaking most people can be trusted or one cannot be too careful dealing with other people

(1- one cannot be too careful, 10-most people can be trusted

Most people would try to take advantage of you or they would be fair in dealing with you?

(1-to take advantage, 10- be fair)

Most people think only about themselves or people are generally helpful

(1- think about themselves, 10-helpful)

4. Cooperative communication

1- Rate please the following statements according to the degree of agreement.

(5- strongly agree, 4 -agree, 3- nether, nor, 2 disagree, 1 strongly disagree)

2- I do not want to be talkative

(5- strongly agree, 4 -agree, 3- nether, nor, 2 disagree, 1 strongly disagree)

3- I am not tight-lipped

(5- strongly agree, 4 -agree, 3- nether, nor, 2 disagree, 1 strongly disagree)

4- I never say anything that is in my knowledge is false

(5- strongly agree, 4 -agree, 3- nether, nor, 2 disagree, 1 strongly disagree)

5- What I say is always true in my opinion

(5- strongly agree, 4 -agree, 3- nether, nor, 2 disagree, 1 strongly disagree)

5-I only say what matters

(5- strongly agree, 4 -agree, 3- nether, nor, 2 disagree, 1 strongly disagree)

6- I do not like redundant speeches

(5- strongly agree, 4 -agree, 3- nether, nor, 2 disagree, 1 strongly disagree)

7- I hate to be cryptic

(5- strongly agree, 4 -agree, 3- nether, nor, 2 disagree, 1 strongly disagree)

8- I want to be understood therefore I try to be clear and unequivocal

(5- strongly agree, 4 -agree, 3- nether, nor, 2 disagree, 1 strongly disagree)