COOPERATIVE STRATEGIES IN TEACHING OF WEB-PROGRAMMING

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In recent decades, the cooperative learning has been one of the most intensively studied teaching methods. Many empirical evidences, in educational research, prove that students' academic achievement, motivation, and social skills can develop much faster by using cooperative methods than in frontal or individual education. These advantages of cooperative learning can be utilized in college education, and it is very important in the situation of credit-system, where possibilities of social learning and students' professional communication are abated. In this study the main principles of cooperative learning are reviewed, and the techniques used in teaching web-programming are presented. We conducted an experiment with a small college student sample (n = 24). The most important results of this project are shown in the paper.

Keywords: cooperative learning, social skills, motivation to learn

College teachers often mention that the most serious problems in college education are the students' lack of academic skills, abilities, knowledge, their low-level motivation, and interest in learning. An increasing amount of criticism, opposing the most frequently used teaching methods, is formed in the Hungarian education system and educational research. The traditional teaching methods of college teaching, like lecturing to hundreds of students or the presentation-like, frontal seminars can not cause positive changes in students' motivation and social skills. The credit system, has become general in colleges during recent years, does not support the formation of students' groups as the class system did. The traditional class system helped students experience the strengths of social learning as opposed to the credit system where a student attends each class with different students. Well developed social skills and

motivation are as important as professional skills in workplace integration. That is the reason for the college teaching has to find and apply new methods that can improve these competences.

The educational research pays more and more attention to the studying of different kind of innovative teaching methods like cooperative learning. Using this method of learning organization and direction (Slavin, 1995) dynamically develops in West-Europe and in North-America from the 1970s, and it is spreading in Hungary too, mainly in primary schools and high schools. In Hungary, József Benda started to use cooperative learning methods (Benda, 2002a) from the 1980s. The so-called "humanistic cooperative education" founded by him is based on cooperation not only among students or student groups, but the whole model is organized around cooperation. The spreading of cooperative learning in Hungary was helped primarily by Spencer Kagan's methodical book (2004). In recent years, many studies, across all levels from primary grades through high schools, were issued to present methodology and possibilities of applying cooperative learning. Teachers, who tried cooperative strategies, usually report positive impressions and experiences (Józsa and Székely, 2004).

A short introduction to cooperative learning, its basic principles, and the role of motivation and social skills in cooperative learning is given in this article. After that the most important conclusions of Hungarian empirical studies on effects of cooperative strategies are presented. Finally, the experiences came from teaching web-programming in college teaching, and empirical results of this experiment are shared in the paper.

Cooperative techniques and their effects

Basic concepts of cooperative learning

The roles of the teacher are significantly changed during the cooperative learning in comparison with frontal teaching. The aim is not only to transfer knowledge to students and develop their cognitive skills and abilities, but, at the same time, to improve students' motivation to learn and social skills. For this, the educator utilizes a wide range of student motives because this way he/she can increase students' ambitions oriented to active participation. The teacher initiates and controls the work of cooperative groups in such a way that they can solve their job only if they utilize the knowledge and skills of every group-member. Two important principles in cooperative learning are "positive interdependence", and "equal participation" (Kagan, 2004). "Individual accountability" is also necessary to this equal and active participation.

Expectations from cooperative learning are higher than those from simple group work. In the case of group work, the principles “individual accountability“ and “positive interdependence“ do not form spontaneously. For this reason the “equal participation“ easily gets violated. For example, when there is one or two active member in a traditional group, they can do the work of others.

The educator's role in cooperative learning is not to transfer the curriculum. In cases of many cooperative techniques the students will take over this job. But, preferably, the educator has to organize and conduct students' activities in such a way that, with “simultaneous interactions“ of students, makes possible these principles to come true.

It seems that preparing cooperative lessons requires a lot of work. What positive results of cooperative learning can be expected? Why are the educators interested in investing more attention and energy in teaching process?

The role of the cognitive motivation and social skills in cooperative learning

The student's inclination towards learning is the strongest when more than one type of motivation is in action at the same time. The frontal or individual teaching is based not only on one type of motivation. Feeling the mastery pleasure, thirst for compliance to the teacher's expectations, motive of competition, the reward as an extrinsic motivation etc. can all affect student behaviour. But, in the situation of cooperative learning the educator can consciously activate additional learning and social motives.

As it can often be experienced (e.g. at a boring workplace meeting), when our level of activation falls down, we immediately start to find a new stimulus (Nagy, 2000): we make some scrawl, move on our chair, and sometimes chat a bit with each other. It happens similarly in the classrooms, but some teachers often rank students' arousal as indiscipline. However, with appropriate organizing and conducting, the educator can utilize students' arousal as a need to act in the learning process. During the social learning, based on students' actions, the motivation of these needs can be activated naturally. It can also help acquire knowledge, and improve skills and abilities (Józsa and Székely, 2004).

The students' need to communicate can also be identified as a difficulty of student behavior, in case of a frontal or individual lesson. This motivation can also be utilized in cooperative learning because the communication and simultaneous interaction is an important and effective element of cooperative strategies.

Cooperative learning situations allow experiencing the growth of knowledge, and the pleasure of discovery with each other. Students can lose themselves in work, and can feel the “flow“, as Csíkszentmihályi calls

(Csíkszentmihályi, 2001). This condition may increase the efficiency of learning, may accelerate improvement of skills, because it operates as a very strong motivation (Józsa and Székely, 2004). Additionally, the challenging power of the learning exercise can be optimal in a well organized, cooperative situation, and it may cause operating and improving so-called mastery motivation, which plays a fundamental role in the process of developing skills (Józsa, 2005).

The strength of motivation and particular elements of the motivating system can be significantly different for each student. However, the more motives are operated in a learning situation, the more mutual deepened effects have on each other. This interaction among motives can makes the learning process more successful (Józsa, 2002). The successful and enjoyable learning can cause the improvement of social motivation, motivation to learn, social skills, as well as better academic achievement. "The great possibility of cooperative learning is that it simultaneously effects the development of cognitive and social competency. All this can be an enjoyable and lifelike experience for students. The skills and motivation are used as they are used in the everyday life" (Józsa and Székely, 2004). Why are these effects so important from education standpoint?

As the experiences of longitudinal studies show that the spontaneous development of social skills is unsatisfying at the end of both the elementary school (Zsolnai and Józsa, 2002) and secondary school (Józsa and Zsolnai, 2005). Similarly, social skills of college students are not developed enough (Csizmás and Pap-Szigeti, 2006). The education has to attend to improving social skills because, as the statistics show, more employees loose their first work because of their deficits in social than in professional skills.

The strength of motivation to learn usually decreases during the school years (Józsa, 2002). Innovative teaching methods can help stop or slow down this decrease. Furthermore, cooperative lessons can reduce anxiety concerning school and learning situations. While wrong answers are immediately evaluated during a traditional lesson (and in the public eye of the class), it is possible, before the evaluation, to discuss the curriculum, and to correct mistakes or misunderstandings in cooperative groups (Kagan, 2004).

Educators, who often use cooperative strategies, do not debate that it is not necessary and not ideal to build the whole learning process on cooperative learning. Sometimes the teacher has to summarize the material or clarify misunderstandings. Skills which make it possible to follow and to keep notes the long lectures, have to be improved, too. The competitive strategies are essential in solving everyday problems (Mérő, 1996). For this reason, education has to improve a widened base of the motivation and skills, which make the

self-adapting possible to different situations. Furthermore, teachers have to optimally proportionate different methods (Kagan, 2004). It can be supposed that this optimal proportion has not formed in Hungarian education, including college teaching.

The educator's new roles in cooperative learning

As it is mentioned above, the teachers are not regarded as the source of knowledge primarily. Since they get rid of permanent transferring knowledge, they can utilize their energy in observing students' work and cooperation, and in intervening in the process.

The educator is responsible for academic and social aims but, in case of cooperative learning, he/she also has to determine some other options. The teacher forms groups (the aspects and techniques of forming groups can be found in Kagan's book). He/she determines exercise and function of each student in the group, the learning environment, and tools (Óhidy, 2005). All of these decisions require intensive thinking from the teacher, and a lot of time. Preparing of cooperative material and tools is time-consuming, too.

Giving the exercises to group-members is an essential element of learning organization because it helps attain the positive interdependences among members, and the individual accountability of students. For this reason, the criteria of success and the expects concerning students' behavior should be clearly formulated and announced (Óhidy, 2005). The effective giving of exercises can be helped with a teacher's presentation, or short instructions fitting to the age of students. It is worth to make it sure that everybody understood the instructions (Kagan, 2004).

During cooperative learning the educator may pay attention to the learning direction (Kagan, 2004). He/she can observe and control the students' behavior and interactions among students but, at the same time, the teacher has to ensure the condition of permanent work. It requires a lot of attention (Óhidy, 2005). However, the students' activity opens the door to perceive problems in learning or communication, opposite frontal teaching, where sometimes the problems are perceived during the summative evaluations.

All of the above-mentioned factors give new possibilities in the evaluation of students. The communication formed in the groups allows the improvement of students' self-evaluation by the analysis of their own work and the work of the group (Óhidy, 2005). The evaluation includes the mastering of the curriculum as well as the gaining of social aims (“How could I take part in the work?“, “Did I understand my mates' questions or problems?“ etc.). The educator can evaluate the achievement of the group, the communication among members, or the results of the whole class (Óhidy, 2005). The competition

among groups can be effective; however, it may be more effective if the teacher appoints an aim for the whole class. For example, using class aims with the technique “jigsaw“ (Clark and Wideman, 1989), will be introduced later, we can observe communication between “experts“ of particular groups, without the teacher's encouragement.

Cooperative learning as a methodology affects all phases of the teachers' work. Organizing, preparing, controlling, and evaluating the cooperative learning requires more work and more time than frontal teaching. It is true, mainly in the first period, that when the teacher has a little practice in using cooperative techniques, and has to develop cooperative material and tools. However, evidences come from dozens of empirical studies demonstrate that it is worthy to invest more energy to acquiring and using cooperative strategies (Klein and Shnackenberg, 2000; Humphreys, Johnson, and Johnson, 1982; Wehrs, 2002; Box and Little, 2003; Ghaith and Bouzeineddine, 2003; Slavin, 1983).

Some results of empirical studies on cooperative learning

Studying methodology and efficiency of cooperative learning is a hot topic in educational research. A recent search of the ERIC education database provided over 7,000 citations for expression “cooperative learning“. The efficiency was studied in almost every subject, across all levels of education. The analysis embodies changing of academic achievement, improving of motivation to learn and social competency as well as connections between these components (Klein and Shnackenberg, 2000; Humphreys, Johnson, and Johnson, 1982; Wehrs, 2002; Box and Little, 2003; Ghaith and Bouzeineddine, 2003; Slavin, 1983).

There were only a few Hungarian empirical studies that analyzed the effects of cooperative strategies. In his case study with children at the age of 9 to 11, József Benda (Benda, 2002b) described that cooperative learning can cause auspicious changes in improving skills and in attitudes for school.

The study of Krisztán Józsa and Györgyi Székely (Józsa and Székely, 2004) focused on high school students at the age of 15 (in the 9th grade). They use cooperative strategies to teach solving text problems in mathematics, in the experimental group. Frontal teaching was used in the control group. They studied if the text problem solving skill develops faster during cooperative learning than frontal teaching or not. Besides this, they analyzed changes in students' social skills, mastery motivation, and mathematics self-concept, the connection between these components and the level of text problem solving skill. They collected the experiences and opinions from teachers and students

participated in the experiment. The students were regrouped many times during the experiment. They used various techniques of teaching and different kinds of evaluation methods. Both the higher achieving student as well as the student who helped the most in the work of the group were complimented. Than students received information on the achievement and improvement of other classes, and could compare this with their own results.

The motivation to learn, e.g. mastery motivation, competition, or mathematics self-concept did not change significantly during the short period of the experiment (it was only 12 running lesson) (Box and Little, 2003; Mérő, 1996). However, in case of some items that studied the attitude of students to mathematics ("I hate to think about mathematics.", "I feel good in math classes."), significant improvements happened. Skills of cooperation were also improved during the experiment.

The experimental group showed significant development regarding text problem solving skills compared to the control data ($\sigma = 0.49$), and the decrease of the relative deviation in the experimental group was greater than in the control group. Individual order by the development of text problem solving was significantly changed in both groups. It goes to show that both of cooperative and traditional strategies can affect individual development. Students, who were in the upper third of achievement in the experimental group at the beginning of the experiment, developed the same way as the whole experimental group. It answers the teachers' most frequently asked question: can students with low achievement develop at the expense of students with high achievement? (Kagan, 2004) Agreeing with Kagan: "As teachers we know that we learn during teaching... While we are thinking about making the material easier, we acquire a deeper knowledge on it." (Kagan, 2004:1-2) Teaching a mate is a motivated situation. It may cause effective learning for the student in the teacher's role.

Cooperative methods in teaching web-programming

Some problems of college teaching is mentioned in the introduction. It is worth to find new methods to help the solution. Possibilities of cooperative learning was started to study because of sensing the students' low interest in learning and in their mates. Deficits in social skills and skills of communication are perceptible in the classrooms or during their examinations. However, students' motivation to learn and social motivation is more developed than it is supposed by the educators (Csizmás and Pap-Szigeti, 2006). For this reason, these components can be utilized during cooperative learning.

In teaching web-programming the aim of developing academic achievement, social skills, attitudes to programming, and the motivation to learn is appointed,

in the long term. In the first semester, we have a small sample, so we created cooperative materials only, and tried those in the classroom. During and at the end of the semester students' feedbacks and experiences about cooperative learning were collected. At the end of this chapter some information about empirical data can be found but, because of the small sample, the conclusions are not reliable. For this reason, we plan to repeat this experiment with a larger sample and a control group next year.

Introduction to the subject

Students at GAMF can study the creating of dynamic web pages in an option named “web-programming and databases“. They use the programming language php, and MySQL for storing data. This subject is strongly integrative, it is based on knowledge and skills acquired in “C programming“ and “database systems“. The curriculum is practical, but the necessary academic skills were frontally presented in training sessions by the educator, in earlier semesters.

The students often study in different classes, so their pre-knowledge is very different. On the other hand, only a little communication can be observed between students. Cooperative learning is a good framework to decrease individual differences and to utilize individual knowledge. I can be supposed that developing students' skills of cooperation can be helped by the increase of in-group communication (Kagan, 2004; Józsa and Székely, 2004).

Methods used in teaching and learning

We used only a few basic methods from the large toolbox of cooperative learning. Not all the parts of the curriculum were processed by cooperative methods. Individual learning was often used during exercises. In this chapter, we give our solutions to process, practice, repeat, and apply the material. Whole process of learning was organized on the grounds of these techniques. Kagan's (2004) notations are used in this chapter.

The groups were formed under the direction of the teacher. The most students did not know their classmates and the teacher did not know them. For this reason, a random group forming based on the layout of the classroom was chosen. József Benda (Benda, 2002a) suggests 3 to 5 persons, Spencer Kagan suggests 4 persons in groups. We chose that all groups had 3 members, because sometimes they had to use one screen. There was a possibility to reformulate groups based on results of their first paper, but students strongly opposed to it, so we could not carry out our decision.

The first activity of the groups was a short interview. A member of a group interviewed an other member, and the name, field of study etc. were gathered. After that, the interviewer introduced his/her mate to the third member, who did not hear the interview. After three changes of roles they knew each other's name well.

A variation of jigsaw (Kagan, 2004; Clark and Wideman, 1989) was the most frequently applied method to acquire new materials. The material was divided into three parts which were understandable in the abstract. For example, in the lesson sounded arrays and file handling, one of the members of each groups read about creating, filling and using the php arrays. Another member read about different ways to iterate over arrays (e.g. foreach, which is unused in C language), the third one read about opening, reading, and writing files, and the important file handling functions. In the first step of jigsaw method, everybody read his/her text, and had an opportunity to try the new elements on a computer. In this phase, everybody was able to consult with the other groups' "experts" who had the same text. In the second step, all group members taught group-mates the material. The actual "teacher" could use a computer to demonstrate statements or functions. In the third step, they had to make sure that every group member understood the whole material. After the three steps, every group got an exercise, and they had to solve it with each other, using the members' "expertise". The exercise of the above example is shown in Figure 1.

Sometimes a competition was used among groups, but the work was more motivated when the operating of all groups' program was the criteria of a "reward".

Figure 1. A cooperative exercise on arrays and files

In the directory p:/exercises you can find five text files (square1.txt etc.). All of these files contain 9 numbers in 3 rows, divided by a semicolon. We imagine these numbers as a matrix. 1. Make a new web page (e.g. choose.php) containing a form, and use a dropdown list to enable choosing a file. The name of the chosen file has to be sent to page determ.php! (You can use a loop to create the dropdown list and the value of items can come from the file name.) 2. The determ.php should receive the name of the file, and check if the file exists (if no, write an error string)! If the file exists, you should read the content of the file, and then explode the lines to a two-dimensional array! Show the matrix in an HTML table, and write the determinante of the matrix!

Flashcards (Kagan, 2004) was often used as a tool for acquiring statements or functions of php language. One side of the card contained the name of the statement of the function. On the other side, you could read about arguments

and functionality of this element (see Fig. 2.). The students worked in pairs, and every student got four or five different cards. In the first step, one of them read the name, then turn round the card and read the information. His/her mate had to repeat it immediately. After changing the roles, in the second step, the "teacher" read the name of element only, and the mate had to recall the information, with a little help if necessary. In the third step they worked without help. Naturally, every repetition increases the probability of successful recalling. Flashcards can be used at the end of the lesson again, or at the beginning of next lesson.

Figure 2. A sample flashcard

function: explode()	Splits a string by string. Returns an array of strings, each of which is a substring of the second argument formed by splitting it on boundaries formed by the first argument.

At the end of a lesson or at the beginning of the next lesson the students' quartet can be used for checking knowledge. All group members had a number. After each question the teacher gave a little time for the groups to discuss. They could consult with each other, but everybody had to know the correct answer after a few minutes. They did not know that which member will answer, so they were all interested in sharing their knowledge in the group. After the "consultation", the teacher called a number and the students wearing this number should appear, then one of them answered (Kagan, 2004). Our aim was that everybody knew the answer, even though some of them learned it right there and then.

During the frontal teaching, the teacher gets the correct answer for almost every question, however not almost every student knows this answer. In this case, the students are interested in unsuccessful of their classmates. The teacher "has set up a competition between the students. The students want to earn her approval, and they can do this only at the expense of their classmates" (Slavin, 1995:3). As it was mentioned, sometimes the competition is useful, but students have to learn the cooperation as well, and the student quartet is an effective technique for this.

With the game blind hands (Kagan, 2004), the memory, the attention, and the skill of ordering can be improved. Everybody in the group got one or two lines from a program code. After the understanding, they had to explain each other what the activity of their fragment was. After that, without helping each other,

they had to place their papers on the table in the right order, upside down. At the end they could check the correct order. If the problem was too hard, the groups could be helped with allowing some discussion about functionality of the whole program.

It is frequent that php scripts have more than one input parameter and functionality. We can use round table during designing our programs. An initially blank paper circulated on the table and the students, one after the other, had to describe a functionality of the program. When all functionalities were gathered, the student had to describe the parameters and their values identifying the particular functionality. This method can help to separate the possible cases.

The cooperation and the social behavior were emphasized in the evaluation of the students' and the groups' work. Primarily the students used self-evaluation in groups, while the teacher evaluated activity of each group. Sometimes a whole-class aim was appointed. In this case the groups evaluated each other as well.

The curriculum of this subject gives good opportunities to use more cooperative techniques than it happened in this semester. Before the larger sample experiment we should re-analyze the curriculum and the possibilities of inserting new techniques.

Methods and results

As the sample was too small, only two classes of students, we did not organize a comparative study with a control group. Our aim was to try to create and install cooperative materials and tools. In this chapter the results of the experiment are presented. However, we emphasize that our conclusions will be reliable after a large sampled experiment with a control group.

26 students were taking this subject in these two classes, and 24 out of them passed. All of these students participated in a faculty-wide study at the beginning of the semester (n = 286). In this study their inductive thinking (Csapó, 2002) and with a questionnaire based on a questionnaire of Krisztián Józsa and Anikó Zsolnai, motivation to learn (Józsa, 2005; Józsa, 2002) and social skills were measured. The questionnaire contained five-graded Likert-style sentences, and we created some complex variables using factor-analysis (Csizmás and Pap-Szigeti, 2006).

The experimental group did not segregate significantly from the students' body by the qualification of parents ($\chi 2 = 2.93$, $p > 0.05$), inductive thinking ($\mu = 61.9$ %p, $\sigma = 14.9$ %p, $\bar{x} = 62.2$ %p; $u = 0.10$, $p > 0.05$), social skills ($\mu = 65.9$ %p, $\sigma = 11.4$ %p, $\bar{x} = 63.8$ %p; $u = 0.91$, $p > 0.05$), or strength of mastery motivation ($\mu = 58.7$ %p, $\sigma = 12.1$ %p, $\bar{x} = 59.8$ %p; $u = 0.45$, $p > 0.05$).

The posttests were recorded three months later, only in the experimental group, because it can be supposed that spontaneous development of measured components is not significant (Józsa and Székely, 2004) within a short time. It was not planned to compare the academic achievement with a control group's results. We only made sure that the actual results experienced by teacher are not worse compared to results of previous semesters. This comparison is methodically not correct, because the test was not the same in these semesters.

The development of the social skills was significant but little in the experimental period ($x1 = 63.8$ %p; $x2 = 67.6$ %p; $t = 5.62$; $p < 0.05$). The change of the motivation to learn, especially in mastery motivation and programming self-concept, was not significant (the programming self-concept have a significant effect on results of programming subjects - Csizmás and Pap-Szigeti, 2006).

Out of sentences of the questionnaire it is worth to emphasize one sentence "I like to study with others". In the pretest the average of the responses of experimental groups' students was 2.89, it increased to 3.36 at the posttest. The development was significant, and the modus of the responses changed from value seldom (2) to middling (3).

Some of the students' in-semester feedback emphasized disadvantages of cooperative learning. These feedback data mainly regarded to students' explanations, as they were not as exact as those of the educators. Some feedbacks described that the students could not make proper notes. More attention should be paid to this in the future. Some anxieties were drown, e.g. "I am always afraid of my failure in explaining the material to the others".

Most of the feedbacks were positive at the end of the semester. Some students' opinion emphasized that they need experiences of cooperative tasks when they will get a job. Some of them felt that it was easier to acquire the material this way, as a student said: "It was easy for me to learn at home because I remembered materials what I had to teach."

The less absence and the more activity were observable in lessons. Much to our delight, we experienced positive changes in students' social behavior. At the end of the semester they kindly asked or gave help when we did not emphasize this opportunity. We could observe more interpersonal communication than in previous semesters.

During this semester, we had to eliminate only a little part of the curriculum, as opposed to other semesters when we did the whole curriculum. One of the most important outcomes of the semester was that cooperative materials, tools and exercises were applied to the most part of the curriculum.

Summary

Developing methodology of the cooperative learning can help college teaching with handling some of its problems. It was presented how the cooperative techniques utilize a wide scale of students' motivation for making the education more effective and for improving both motivation to learn and social skills. We built our experiment on conclusions of methodical and empirical studies, and integrated the cooperative learning to the practice of college teaching. Some examples on techniques used in the class were given, and our experiences and empirical results were presented. A positive change was observed in students' social behavior, activity, and motivation. Only a small sample was used, however, it is encouraging that none of the variables was dropped back, and the social skills showed a significant development.

According to our plans, we would like to organize a larger sample experiment with a control group, where we can introduce new cooperative techniques. The larger sample experiment will give an opportunity to study effects and teacher-dependence of methods, and to analyze the development of skills and motivation, and their connection system.

References

BENDA, J. (2002a): *A kooperatív pedagógia szocializációs sikerei és lehetőségei Magyarországon I*. Új Pedagógiai Szemle, No. 9, pp. 26-37.

BENDA, J. (2002b): *A kooperatív pedagógia szocializációs sikerei és lehetőségei Magyarországon II*. Új Pedagógiai Szemle, No. 10, pp. 21-33.

BOX, J. A. and LITTLE, D. C. (2003): *Cooperative small-group instruction combined with advanced organizers and their relationship to self-concept and social studies achievement of elementary.* Journal of Instructional Psychology, Vol. 30, No. 4, pp. 285-287.

CLARK, J. and WIDEMAN, R. (1989): *Cooperative Learning. The Jigsaw Strategy.* Alemany Press, Hayward, CA

CSAPÓ, B. (2002): *Az új tudás képződésének eszköze: az induktív gondolkodás*. In: Csapó Benő (ed.): Az iskolai tudás. 2nd edition. Osiris Kiadó, Budapest, pp. 261-290.

CSÍKSZENTMIHÁLYI, M. (2001): *Flow. Az áramlat. A tökéletes élmény pszichológiája*. Akadémiai Kiadó, Budapest

CSIZMÁS, E. and PAP-SZIGETI, R. (2006): *Műszaki informatikus hallgatók programozási eredményei a tanulási motiváció és az értelmi képességek tükrében*. Előadás, Matematika, fizika és számítástechnika oktatók XXX. Konferenciája, Pécs

GHAITH, G. M. and BOUZEINEDDINE, A. R. (2003): *Relationship between reading attitudes, achievement, and learners' perceptions of their Jigsaw II. cooperative learning experience*. Reading Psychology, Vol. 24, pp. 105-121.

HUMPHREYS, B., JOHNSON, R. T. and JOHNSON, D. W. (1982): *Effects of cooperative, competitive, and individualistic learning on students' achievement in science class*. Journal of Research in Science Teaching, No. 19, pp. 351-356.
JÓZSA, K. and SZÉKELY, Gy. (2004): *Kísérlet a kooperatív tanulás alkalmazására a matematika tanítása során*. Magyar Pedagógia, Vol. 104. No. 3, pp. 339-362.
JÓZSA, K. and ZSOLNAI, A. (2005): *A longitudinal study of social skills development in adolescents*. Paper presented at 11th European Conference for Research on Learning and Instruction, Nicosia, Cyprus
JÓZSA, K. (2005): *A képességek és motívumok kölcsönös fejlesztésének lehetősége*. In: Kelemen, E. and Falus, I. (eds.): Tanulmányok a neveléstudomány köréből. Műszaki Könyvkiadó, Budapest, pp. 283-302.
JÓZSA, K. (2002): *Tanulási motiváció és humán műveltség*. In: Csapó, B. (ed.): Az iskolai műveltség. Osiris Kiadó, Budapest, pp. 239-268.
KAGAN, S. (2004): *Kooperatív tanulás*. Ökonet Kft., Budapest
KLEIN, J. D. and SHNACKENBERG, H. L. (2000): *Effects of informal cooperative learning and the affiliation motive on achievement, attitude and student interactions*. Contemporary Educational Psychology, No. 25, pp. 332-341.
MÉRŐ, L. (1996): *Mindenki másképp egyforma*. Tericum Kiadó, Budapest
NAGY, J. (2000): *XXI. század és nevelés*. Osiris Kiadó, Budapest
ÓHIDY, A. (2005): *Az eredményes tanítási óra jellemzői. Kooperatív tanulási formák a gyakorlatban*. Új Pedagógiai Szemle, No. 12, pp. 100-108.
SLAVIN, R. E. (1995): *Cooperative Learning*. Simon and Schuster Company, Needham Heights
SLAVIN, R. E. (1983): *When Does Cooperative Learning Increase Student Achievement*? Psychological Bulletin, Vol. 94, pp. 429-445.
WEHRS, W. (2002): *An assessment of the effectiveness of cooperative learning in introductory information systems*. Journal of Information Systems Education, No. 1
ZSOLNAI, A. and JÓZSA, K. (2002): *A szociális készségek kritériumorientált fejlesztésének lehetőségei*. Iskolakultúra, No. 4, pp. 12-20.