Technical Appendix

Collaborative learning[i]

Moderate impact for very low cost, based on extensive evidence.

Definition

Collaborative or cooperative learning is defined as learning tasks or activities where students work together in a group small enough for everyone to participate on a collective task that has been clearly assigned. Each student can then achieve his or her learning goal if and only if the other group members achieve theirs. Cooperative learning can result in better achievement, improved intergroup relations, acceptance of mainstreamed classmates, enhanced self-esteem, and positive attitudes.

Search terms: cooperative/collaborative learning; group activities; cooperative/collaborative learning instruction/strategies

Evidence Rating

There are ten meta-analyses, with five conducted in the last ten years, which suggest that collaborative learning strategies can improve learning. However, the effects vary, with pooled effects between 0.09 and 0.91 and there is no clear explanation of why this spread occurs. It appears that collaborative learning can work well for all ages if activities are suitably structured for learners' capabilities, and positive evidence has been found across the curriculum. Overall, the evidence is rated as extensive.

Cost Information

Overall the costs are estimated as very low. Ongoing training for teachers is advisable, with estimated costs of about £500 per teacher, or £20 per pupil per year for a class of 25 pupils.

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Summary of effects

Meta-analyses	Effect size	FSM effect size	
Capar, G., & Tarim, K. (2015)	0.59	-	Maths
Igel, C. C. (2010)	0.44	-	
Johnson, D.W., Maruyama, G., Johnson, R., & Nelson, D. (1981)	0.78	-	(co-operative vs individualistic)
		-	(co-op v competitive)
Johnson, D. W., Johnson, R. T., & Stanne, M. B. (2000)	0.91	-	(learning together)
	0.62	-	(group investigation)
	0.86	-	(academic controversy)
	0.09	-	(jigsaw groups)
	0.28	-	(student-team achievement)
	0.18	-	(co-op read & composition)
	0.19	-	(team assisted individualization)
Kyndt, E., Raes, E., Lismont, B., Timmers, F., Dochy, F., & Cascallar, E. (2013)	0.54	-	
Nunnery, J. A., Chappell, S., & Arnold, P. (2013)	0.16	-	
Otman, N. (1999)	0.26	-	
Puzio, K., & Colby, G. T. (2013)	0.2	-	
Romero C.C. (2009)	0.4	-	
Roseth C.J., Johnson D.W., Johnson R.T. (2008)	0.46	-	(competitive vs cooperative)
	0.55	-	(co-operative vs individual)
Stoner, D. A. (2004)	0.13	-	Maths
Single Studies			
Borman, G. D., Slavin, R. E., Cheung, A. C., Chamberlain, A. M., Madden, N. A., & Chambers, B. (2007)	0.21	0.09	
Weighted mean	**0.38**		

Meta-analyses abstracts

3

Capar, G., & Tarim, K. (2015)

This research compiles experimental studies from 1988 to 2010 that examined the influence of the cooperative learning method, as compared with that of traditional methods, on mathematics achievement and on attitudes towards mathematics. The related field was searched using the following key words in Turkish "matematik ve işbirlikli öğrenme, kubaşık öğrenme, işbirlikçi öğrenme" and in English "cooperative learning and mathematics, meta-analysis." This study covered reports, articles published in refereed journals, and MA and Ph.D. theses. For the international literature review, advanced databases, such as ProQuest Digital Dissertations, EBSCO, and Eric, were mined. A total of 26 studies (n = 36) were considered in the meta-analysis. The effect size for coopera-tive learning on academic achievement was found to be d++ = 0.59 (95% CI: 0.38 between 0.80) and the effect size for cooperative learning on attitudes towards mathematics was found to be d = 0.16. In terms of achievement, the effect size was found to be medium, positive, and significant, but for attitude, it was small, positive, and significant. As a result, cooperative learning was reported to be a more successful method than the traditional method with regard to both achievements and attitudes.

7

Igel, C. C. (2010)

Cooperative instruction is one of the most theoretically-grounded, popular, and misunderstood of the instructional strategies. Grounded within social-psychology and learning theory, properly specified cooperative instruction requires design elements such as positive interdependence and individual accountability that go beyond basic group-mediated instruction. Despite its popularity and a large corpus of literature, practitioners and researchers alike often confuse cooperative instruction with less stringent forms of group-mediated instruction. The present study clarifies this distinction, and meta-analyzes the results of twenty rigorous studies on the effect of cooperative interventions on K-12 student learning. The meta-analysis employs rigorous selection criteria to maintain internal validity and newly developed statistical adjustments to account for analytic errors found throughout much of the primary research base. Findings reveal a moderate overall effect (0.44) for cooperative interventions with differential estimates across a range of moderators. These finding are placed within the context of the larger corpus of research on cooperative learning and its implications for practitioners discussed.

8

Johnson, D.W., Maruyama, G., Johnson, R., & Nelson, D. (1981)

We reviewed 122 studies and compared the relative effectiveness of cooperation, cooperation with intergroup competition, interpersonal competition, and individualistic goal structures in promoting achievement and productivity in North American samples. These studies yielded 286 findings. Three meta-analysis procedures were used: voting method, effect-size method, and z-scores method. The results of the meta-analyses indicate (a) that cooperation is considerably more effective than interpersonal competition and individualistic efforts, (b) that cooperation with intergroup competition is also superior to interpersonal competition and individualistic efforts, and (c) that there is no significant difference between interpersonal competitive and individualistic efforts. Through multiple regression, a number of potentially mediating variables for these results are identified.

9

Johnson, D. W., Johnson, R. T., & Stanne, M. B. (2000)

Cooperative learning is one of the most widespread and fruitful areas of theory, research, and practice in education. Reviews of the research, however, have focused either on the entire literature which includes research conducted in non-educational settings or have included only a partial set of studies that may or may not validly represent the whole literature. There has never been a comprehensive review of the research on the effectiveness in increasing achievement of the methods of cooperative learning used in schools. An extensive search found 164 studies investigating eight cooperative learning methods. The studies yielded 194 independent effect sizes representing academic achievement. All eight cooperative learning methods had a significant positive impact on student achievement. When the impact of cooperative learning was compared with competitive learning, Learning Together (LT) promoted the greatest effect, followed by Academic Controversy (AC), Student-Team- Achievement-Divisions (STAD), Teams-Games-Tournaments (TGT), Group Investigation (GI), Jigsaw, Teams-Assisted-Individualization (TAI), and finally Cooperative Integrated Reading and Composition (CIRC). When the impact of cooperative lessons was compared with individualistic learning, LT promotes the greatest effect, followed by AC, GI, TGT, TAI, STAD, Jigsaw, and CIRC. The consistency of the results and the diversity of the cooperative learning methods provide strong validation for its effectiveness.

10

Kyndt, E., Raes, E., Lismont, B., Timmers, F., Dochy, F., & Cascallar, E. (2013)

One of the major conclusive results of the research on learning in formal learning settings of the past decades is that cooperative learning has shown to evoke clear positive effects on different variables. Therefore this meta-analysis has two principal aims. First, it tries to replicate, based on recent studies, the research about the main effects of cooperative learning on three categories of outcomes: achievement, attitudes and perceptions. The second aim is to address potential moderators of the effect of cooperative learning. In total, 65 articles met the criteria for inclusion: studies from 1995 onwards on cooperative learning in primary, secondary or tertiary education conducted in real-life classrooms. This meta-analysis reveals a positive effect of cooperative learning on achievement and attitudes. In the second part of the analysis, the method of cooperative learning, study domain, age level and culture were investigated as possible moderators for achievement. Results show that the study domain, the age level of the students and the culture in which the study took place are associated with variations in effect size.

12

Nunnery, J. A., Chappell, S., & Arnold, P. (2013)

This study synthesizes the mathematics achievement impacts observed in randomized Studies of the Student Teams Achievement Divisions cooperative learning model. A total of 15 randomized studies were retrieved from the extant literature. Analyses of d= +0.16 (Cohen's d) effect size estimates indicated an overall statistically significant positive effect. Estimates were also examined for between-class Heterogeneity to ascertain whether there were Differences in effects for younger children in Elementary settings versus adolescent children in Secondary settings. These analyses indicated That cooperative learning had a much stronger effect on student achievement for adolescent children than for younger children.

13

Othman, N. (1996)

The purpose of this study was to analyze the findings of research on teaching mathematics through the use of cooperative learning versus traditional teaching methods on achievement and attitude from grade K through grade 12. Meta-analysis was selected as the method which to synthesize findings and indicate the size and significance of the effects. Studies were collected from 1970 to 1992 using

educational sources such as ERIC, DAI and Journal for Research in Mathematics Education. In the final analysis there were 40 studies for achievement and 25 studies in attitude. Effects size was calculated for each study using Glass's (1981) and William's (1990) methods. The resulting effects sizes were tested for homogeneity using Hunter and Schmidt's (1990) method. When a heterogeneous result was obtained, then moderating variables were used to create homogeneity of results; since heterogeneous result were still obtained, then the resulting effects sizes were further analyzed using Step-Wise Analysis to obtain categories for homogeneous result. Using the Step-Wise Analysis, the following conclusion was drawn: (a) Peer Tutoring was the best method of instruction for achievement change to occur regardless of rating of research design and (b) Team Assisted Individualization (TAI) was the best method of instruction for attitude change to occur regardless of date of publication.

14

Puzio, K., & Colby, G. T. (2013)

We conducted a meta-analysis on the effectiveness of cooperative and collaborative learning to support enhanced literacy outcomes. Interventions considered were provided in regular education settings (i.e., not pull-out instruction) with students from Grades 2 through 12. Reviewing more than 30 years of literacy research, we located 18 intervention studies with 29 study cohorts. Included studies primarily used standardized assessments to report on students' reading, vocabulary, or comprehension achievement, which we analyzed separately. Overall, students had significantly higher literacy achievement scores when instructional interventions utilized cooperative and collaborative activity structures. The overall weighted mean effect sizes ranged from 0.16 to 0.22 ($p < .01$) with more than 94% of the point estimates being positive. Because cooperative or collaborative learning was always one of multiple intervention components, it was impossible to estimate the unique, added effects of cooperative and/or collaborative learning. Although the small number of eligible studies precludes any claims about the effectiveness of specific forms of grouping and the circumstances under which programs have more impact, our findings suggest that cooperative and collaborative grouping was a core component of effective literacy interventions, particularly at the elementary level.

15

Romero C.C. (2009)

A systematic review of 2,506 published and unpublished citations identified in a literature search on science outcomes associated with cooperative learning in secondary and early post-secondary science classrooms between 1995 and 2007 was conducted. The goal of this review was to determine what

impact cooperative learning had on science achievement of students compared to traditional instruction. A tri-level screening and coding process was implemented and identified 30 original, empirical studies that met the inclusionary criteria while yielding an overall effect size estimate. The minimum methodological criteria for inclusion were as follows: (a) the study utilized a treatment/control design, (b) cooperative learning was the intervention, and the control group experienced traditional instruction, (c) the subjects in included studies were secondary or early-post-secondary students, (d) the study was performed in a science classroom, and (e) student achievement was the outcome measure. This meta-analysis describes the main effect of cooperative learning; additionally, a variety of moderator analyses were conducted in order to determine if particular study and participant characteristics influenced the effect of the intervention. The results of this review indicate that cooperative learning improves student achievement in science. The overall mean effect size was .308, a medium effect (Cohen, 1988). Moderator analyses on study participant characteristics gender and ability level were inconclusive based on the small number of studies in which data on these characteristics were disaggregated. If the intervention was structured in a particular fashion, the effect on student achievement was greater than that for an unstructured intervention. The intervention showed a greater effect on student achievement in biology classes than in other science disciplines. Studies performed using cluster randomized or quasi-experimental without subject matching methodologies showed a greater effect on student achievement in science than studies that used the quasi-experimental with subject matching methodology. Implications for teacher education policy and recommendations for improvements in methodological practices and reporting are given.

16

Roseth C.J., Johnson D.W., Johnson R.T. (2008)

Emphasizing the developmental need for positive peer relationships, in this study the authors tested a social-contextual view of the mechanisms and processes by which early adolescents' achievement and peer relationships may be promoted simultaneously. Meta-analysis was used to review 148 independent studies comparing the relative effectiveness of cooperative, competitive, and individualistic goal structures in promoting early adolescents' achievement and positive peer relationships. These studies represented over 8 decades of research on over 17,000 early adolescents from 11 countries and 4 multinational samples. As predicted by social interdependence theory, results indicate that higher achievement and more positive peer relationships were associated with cooperative rather than competitive or individualistic goal structures. Also as predicted, results show that cooperative goal structures were associated with a positive relation between achievement and positive peer relationships. Implications for theory and application are discussed.

18

Stoner, D. A. (2004)

The purpose of this study was to examine the existing body of literature and through the use meta-analysis determine the effect of cooperative learning strategies on the mathematics achievement of middle-grades students, grades 4-8. A collection of 25 quantitative studies produced an effect size which indicated that cooperative learning strategies have a positive effect] on the mathematics achievement of middle-grades students. Through correlational analysis, the current study examined relationships between the duration of the studies and effect size of the studies. Also examined was the duration of the studies and grade 4 and grade 8 NAEP mathematics proficiency scores for 2003. Correlation Tables as well as scatter plots for each correlation were provided for visual examination. Also examined were the location of the studies; the particular method of data analysis that each study used; and the dependent outcome measure of each of the studies. Conclusions and recommendations for further research were provided.