Clearing House Unterricht

Short Review

Alone, in pairs, or in groups: How do students learn best?

School is a social learning environment where students often work together with classmates in different configurations of peer interaction. But how should this partner or group work be designed to support learning for all students? Tenenbaum and colleagues (2020) address this question in their meta-analysis, "How effective is peer interaction in facilitating learning?" The authors examine whether students who work in partner or group settings learn more than students who work alone, with an adult, or not at all in a waiting group control condition.

META-ANALYSIS AT A GLANCE

Focus of the study	Learning achievement within partner and group work compared to other social forms in the classroom
Target group	7,103 students, ages 4 to 18
Average effect size	Positive, statistically significant advantage of partner and group work over the comparison groups (g = 0.40)
Further findings	Stable positive overall effect across various learning domains and group compositions; Larger effect when learners are asked to reach consensus.

INTRODUCTION. Group and partner work are part of everyday school life for students and teachers alike. They are a popular social form to stimulate the flow of instruction or to connect different learners. From a constructivist perspective, partner and group work offer the opportunity to engage with others' perspectives, induce cognitive conflict, and thereby stimulate learning. In both classroom practice and theory, however, it is unclear which partner and group constellations work best to support learning. Do students learn better in pairs than in groups of three? What impact does the gender constellation of a group have on learning? Might these questions be answered differently depending on the content of the group work? Tenenbaum and colleagues explore these questions in their meta-analysis.

WHAT IS THIS STUDY ABOUT? The meta-analysis addresses the question of whether students who work on tasks in partners or groups learn more successfully, for example, solve more tasks and/or achieve higher-quality outcomes, than students who work on the task alone, not at all, or with an adult. Data are based on 62 publications covering 71 different samples with a total of 7,103 students between the ages of 4 and 18. All considered studies compare the learning success of students who participated in partner and group work with

the learning outcomes of students from at least one of the following three comparison conditions: 1) the students work on the task alone; 2) the students work on the task together with an adult; or 3) the students do not work on the task at all and simply wait (a so-called waiting control group). In each respective primary study, the tasks that had to be solved were the same for all students - regardless of whether they participated in partner and group work or in one of the three comparison conditions. The meta-analysis also examines whether various moderator variables influence learning success during partner and group work. These variables are grouped by the authors into three categories: study design (e.g., frequency of partner and group work); group characteristics (e.g., gender composition); and learning domain of the task (e.g., scientific reasoning). For an overview of all moderator variables studied in these three categories, see the overview of all individual findings.

WHAT DID THIS STUDY FIND? Students who solved tasks during partner or group work showed significantly greater learning success (e.g., more tasks solved) than students in the comparison conditions. This was reflected in the positive and statistically significant overall effect of g = 0.40 (confidence interval: g = 0.27 to g = 0.54). However, when comparing the learning outcomes of students in the three comparison conditions separately with students' outcomes in partner or group work, significant differences emerged. Students who worked with adults achieved just as much learning success as students who solved the tasks in partner or group work. However, students who worked alone or did not work at all in the waiting control condition achieved lower learning gains than students who worked together in partner or group work. In the meta-analysis, learning outcomes were also significantly greater when children and adolescents were instructed to reach consensus during partner or group work (g = 0.61; confidence interval: g = 0.42 to g = 0.81). All other variables of the study design (e.g., frequency of partner or group work) and group characteristics (e.g., age, group size), as well as the learning domain of the task (e.g., spatial reasoning), did not significantly influence the overall positive effect. That is, for student learning success in partner and group work, it did not matter whether the partner or group work was done:

- only once or more than once,
- with young students (age 4-10) or older students (age 11-18),
- in same- or mixed-gendered pairs or groups,
- with two students or more than two students, or
- in the learning areas of creativity, morality, scientific reasoning, spatial reasoning, etc.

HOW DOES THE CLEARING HOUSE UNTERRICHT EVALUATE THIS STUDY? The *Clearing House Unterricht Research Group* evaluates the meta-analysis using the following five questions, guided by the Abelson criteria (1995):

How substantial are the effects? Overall, the meta-analysis shows a significant positive overall effect of g = 0.40. The size of this effect indicates that approximately 65% of the students who worked in partner or group work achieved greater learning success than the

average of students in the other three comparison conditions (waiting control group, working on the task alone, working on the task with an adult). The overall positive effect of *g* = 0.40 is stable across the group characteristics and task learning domains studied, but is influenced by certain features of the study design (i.e., comparison condition, consensus instruction). That is, although some of the individual studies show effects that are below or above the overall effect, it can be assumed that, overall, partner or group work can promote learning under many circumstances. The overall effect (*g* = 0.40) is somewhat smaller compared to two existing meta-analyses that focus less on spontaneous partner and group work and more on practiced cooperative or collaborative learning (see Short Review 4 on the effectiveness of cooperative learning (*g* = 0.54) and Short Review 15 on the effectiveness of collaborative learning with mobile digital devices (*g* = 0.52)). However, when students are instructed to reach consensus during partner or group work, the effect of *g* = 0.61 exceeds the overall effects of the two comparable meta-analyses.

How differentiated are the results? The meta-analysis reports results which are differentiated by learning areas of the tasks and age levels. In the meta-analysis, a total of nine different learning content areas were analyzed separately (e.g., scientific reasoning, mathematical reasoning). In addition, the presented results are differentiated for two age groups, with the breakdown roughly corresponding to the international primary and secondary levels. No statistically significant differences were found within the different learning domains and across the two age groups, meaning that partner and group work have a similar positive effect across different learning domains and age groups in this meta-analysis. It should be noted that the meta-analysis does not differentiate between the various methods used to assess learning success.

How generalizable are the findings? In the present meta-analysis, several moderator analyses were conducted to test generalizability across different study designs, group characteristics, and learning domains. The beneficial effect of partner or group work is robust across all group characteristics (age, group size, gender composition) and learning domains examined. However, it should to be restrictively noted that in some cases only a very few number of studies were included for the different learning domains of the tasks (e.g. only two studies in the creativity learning domain). Furthermore, the meta-analysis does not contain any information on the geographical regions of the studies, which makes direct transferability to STEM instruction in German schools difficult. Even though the positive overall effect can be generalized across certain variables of the study design (frequency and timing of measurement as well as frequency of partner or group work), it is significantly influenced by two other variables of the study design, namely, the type of comparison group and the instruction on consensus building.

What makes this meta-analysis scientifically relevant? The meta-analysis takes into account central points from constructivist learning theories according to Jean Piaget and Lev Vygotsky. These theories maintain that children and adolescents benefit in their development from active (dialogic) exchange with at least one other person. While Piaget assumes that students learn less when working with adults than when working with peers, Vygotsky

assumes that students can also take much benefit from working with adults. The authors of the meta-analysis take these considerations into account by forming their comparison groups. Thus, they investigate the first point by analyzing whether students learn more or are more successful in the task when they are in active (dialogic) exchange with peers (partner or group work), compared to students who work on tasks alone (comparison group). For the second point on which Piaget and Vygotsky differ, they investigate by comparing the learning success of students who work on tasks with peers (partner or group work) with the learning success of students who solve tasks together with adults. The meta-analysis gains further scientific relevance by highlighting existing needs for further research. So far, little is known about whether and how students' social roles or cognitive prerequisites (e.g., prior knowledge) interact in partner and group work and could influence learning success. Furthermore, it is unclear whether the specific duration of group work influences learning success.

How methodologically reliable are the findings? The disclosure and justification of the methodological approach predominantly meets the standards criteria of common requirement guides (e.g. APA Meta-Analysis Reporting Standards). The steps in the selection of primary studies and the analysis of findings are largely transparent. However, in the area of coding the primary studies, more detailed information on the measurement of learning outcomes, the coding of the respective study quality, and the country of origin of the study would have been desirable. Further information on the methodological assessment can be found in our rating sheet.

CONCLUSION FOR CLASSROOM PRACTICE. Partner and group work can be used quickly and in various ways in the classroom. The findings of the present meta-analysis can be taken as an indication that partner and group work can enhance the learning of students between the ages of 4 and 18. Students can benefit from partner and group work, regardless of gender composition or group size. However, for recommendations, the authors of the meta-analysis refer to research findings in social psychology, according to which the phenomenon of "social loafing"[1] occurs much more frequently among older students as well as in groups of six or more.

In order to further stimulate mutual exchange and the adoption of perspectives, especially in the case of controversial topics, it is a good idea to ask the students to reach a consensus. Overall, the meta-analysis provides evidence that learning effects appear to be greater with collaborative learning than with learning alone.

Despite these practical findings, however, the results of the meta-analysis also indicate that further research efforts are needed to make reliable evidence-based statements about specific design options (e.g., duration of group work, composition of groups according to prior knowledge).

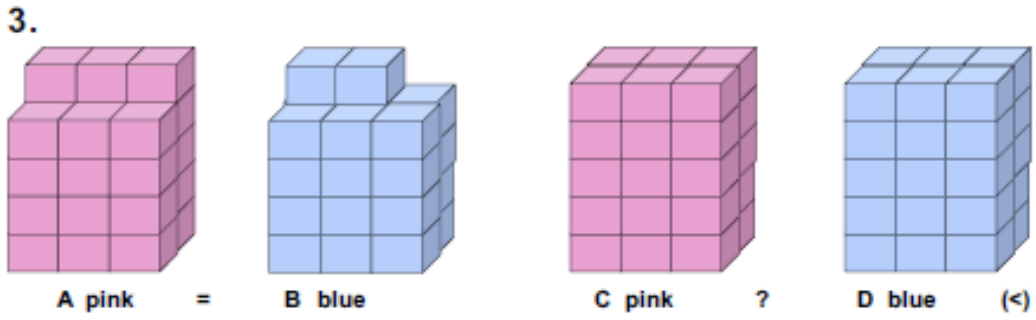
[1] Social loafing refers to the socio-psychological phenomenon that people show less commitment/performance in groups than when working alone. This occurs above all when the identifiability of one's own contribution decreases and disappears in the group contribution.

EXAMPLE STUDY

Schwarz and Linchevski's (2007) study investigated whether partner work leads to improvements in tenth graders' mathematical reasoning compared to a waiting control group. For this purpose, 60 tenth graders from Israel completed a pre- and posttest with mathematical reasoning tasks. There were three weeks between the pretest and posttest. After the pretest, the students were divided into an experimental group and a waiting control group. The 32 students in the experimental group worked together in 16 randomized pairs on 3 of the 9 tasks from the pretest, which then did not appear on the posttest. The central point of the partner work was that the students explain their solutions to each other. The 28 students in the control group waited and did not work on any other tasks between the pretest and posttest. Findings indicated that the tenth graders who had participated in partner work between the pretest and posttest (experimental group) showed a significant increase in the number and quality of solutions to the tasks on the posttest, no significant increase was found for the tenth graders who had only taken the pretest and posttest without partner work (control group).

An example of the mathematical reasoning tasks worked on in the study: Students are shown two pairs of blocks (A, B and C, D); all cubes in blocks A and C weigh the same, all cubes in B and D weigh the same. In all tasks, the number of cubes of block A and block C remains the same, but the number of cubes of block B and D varies. At the beginning of each task, the students are informed about the relative weight of blocks A and B (e.g., block A is heavier than block B). Then they are asked to derive the relative weight of blocks C and D respectively.

Figure 1: An example task: Block A consists of 27 cubes, block C of 30 cubes. Block B consists of 26 cubes, block D of 30 cubes. Block A and B are of equal weight. Is block C lighter than block D? Give reasons.



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LINKS.

To the meta-analysis from Tenenbaum and colleagues (2020).

To the study example from Schwarz and Linchevski, 2007.

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