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Chapter 1 : The power of play – Part 1: Stages of play - MSU Extension

Number Power: A Cooperative Approach to Mathematics and Social Development, Grade 3 Paperback - January 1, by Laurel Robertson (Author), Marji Freeman (Author), Susan Urquhart-Brown (Author), Shaila Regan (Author) & 1 more.

What can it look like? Informal cooperative learning groups In informal cooperative learning, small, temporary, ad-hoc groups of two to four students work together for brief periods in a class, typically up to one class period, to answer questions or respond to prompts posed by the instructor. This video shows an example of informal cooperative learning in a large class taught by Tessa Andrews at the University of Georgia: Additional examples of ways to structure informal group work are given in the table below. Formal cooperative learning groups In formal cooperative learning students work together for one or more class periods to complete a joint task or assignment Johnson et al. There are several features that can help these groups work well: The instructor defines the learning objectives for the activity and assigns students to groups. The groups are typically heterogeneous, with particular attention to the skills that are needed for success in the task. Within the groups, students may be assigned specific roles, with the instructor communicating the criteria for success and the types of social skills that will be needed. Instructors also encourage groups to reflect on their interactions to identify potential improvements for future group work. There are many more specific types of group work that fall under the general descriptions given here, including team-based learning , problem-based learning , and process-oriented guided inquiry learning. The use of cooperative learning groups in instruction is based on the principle of constructivism, with particular attention to the contribution that social interaction can make. In essence, constructivism rests on the idea that individuals learn through building their own knowledge, connecting new ideas and experiences to existing knowledge and experiences to form new or enhanced understanding Bransford, et al. Lev Vygotsky extended this work by examining the relationship between cognitive processes and social activities, developing the sociocultural theory of development. The sociocultural theory of development suggests that learning takes place when students solve problems beyond their current developmental level with the support of their instructor or their peers. Thus both the idea of a zone of proximal development, supported by positive group interdependence, is the basis of cooperative learning Davidson and Major, ; Johnson, et al. Cooperative learning follows this idea as groups work together to learn or solve a problem, with each individual responsible for understanding all aspects. The small groups are essential to this process because students are able to both be heard and to hear their peers, while in a traditional classroom setting students may spend more time listening to what the instructor says. Cooperative learning uses both goal interdependence and resource interdependence to ensure interaction and communication among group members. Changing the role of the instructor from lecturing to facilitating the groups helps foster this social environment for students to learn through interaction. Is there evidence that it works? David Johnson, Roger Johnson, and Karl Smith performed a meta-analysis of studies comparing cooperative learning to competitive learning and individualistic learning in college students Johnson et al. They found that cooperative learning produced greater academic achievement than both competitive learning and individualistic learning across the studies, exhibiting a mean weighted effect size of 0. In essence, these results indicate that cooperative learning increases student academic performance by approximately one-half of a standard deviation when compared to non-cooperative learning models, an effect that is considered moderate. Importantly, the academic achievement measures were defined in each study, and ranged from lower-level cognitive tasks e. The meta-analysis also showed substantial effects on other metrics, including self-esteem and positive attitudes about learning. George Kuh and colleagues also conclude that cooperative group learning promotes student engagement and academic performance Kuh et al. Springer, Stanne, and Donovan confirmed these results in their meta-analysis of 39 studies in university STEM classrooms. They found that students who participated in various types of small-group learning, ranging from extended formal interactions to brief informal interactions, had greater academic achievement, exhibited more favorable

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attitudes towards learning, and had increased persistence through STEM courses than students who did not participate in STEM small-group learning. The box below summarizes three individual studies examining the effects of cooperative learning groups. What are approaches that can help make group work effective? Preparation Articulate your goals for the group work, including both the academic objectives you want the students to achieve and the social skills you want them to develop. Determine the group conformation that will help meet your goals. In informal group learning, groups often form ad hoc from near neighbors in a class. In formal group learning, it is helpful for the instructor to form groups that are heterogeneous with regard to particular skills or abilities relevant to group tasks. For example, groups may be heterogeneous with regard to academic skill in the discipline or with regard to other skills related to the group task e. Groups from are generally recommended, with groups that consist of three members exhibiting the best performance in some problem-solving tasks Johnson et al. To avoid common problems in group work, such as dominance by a single student or conflict avoidance, it can be useful to assign roles to group members e. Assigning these roles is not necessary in well-functioning groups, but can be useful for students who are unfamiliar with or unskilled at group work. Choose an assessment method that will promote positive group interdependence as well as individual accountability. In team-based learning, two approaches promote positive interdependence and individual accountability. First, students take an individual readiness assessment test, and then immediately take the same test again as a group. Their grade is a composite of the two scores. Second, students complete a group project together, and receive a group score on the project. Heller and Hollabaugh describe an approach in which they incorporated group problem-solving into a class. Students regularly solved problems in small groups, turning in a single solution. The University of New South Wales describes a variety of ways to assess group work , ranging from shared group grades, to grades that are averages of individual grades, to strictly individual grades, to a combination of these. They also suggest ways to assess not only the product of the group work but also the process. Again, having a portion of a grade that derives from individual contribution helps combat the free rider problem. Explain how the task involves both positive interdependence and individual accountability, and how you will be assessing each. Assign group roles or give groups prompts to help them articulate effective ways for interaction. The University of New South Wales provides a valuable set of tools to help groups establish good practices when first meeting. The site also provides some exercises for building group dynamics; these may be particularly valuable for groups that will be working on larger projects. Monitoring group work Regularly observe group interactions and progress, either by circulating during group work, collecting in-process documents, or both. When you observe problems, intervene to help students move forward on the task and work together effectively. The University of New South Wales provides handouts that instructors can use to promote effective group interactions, such as a handout to help students listen reflectively or give constructive feedback , or to help groups identify particular problems that they may be encountering. Assessing and reflecting In addition to providing feedback on group and individual performance link to preparation section above , it is also useful to provide a structure for groups to reflect on what worked well in their group and what could be improved. Graham Gibbs suggests using the checklists shown below. The University of New South Wales provides other reflective activities that may help students identify effective group practices and avoid ineffective practices in future cooperative learning experiences. Brain, mind, experience, and school. Higher education, interdependence, and the authority of knowledge. Johns Hopkins University Press. Journal of College Student Development, 43 1 , Cooperative learning, collaborative learning, and problem-based learning. The role of cooperative leaning in increasing problem-solving ability in a college remedial course. Journal for Research in Mathematics Education, 22 5 , Collaborative Learning enhances critical thinking. Journal of Technology Education, 7 1. Designing problems and structuring groups. American Journal of Physics 60, Cooperation in the university classroom 3rd edition. Cooperation in the classroom 8th edition. Improving university instruction by basing practice on validated theory. Journl on Excellence in College Teaching 25, Implementation of cooperative learning in a large-enrollment basic mechanics course. Piecing together the student success puzzle: Integrating

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collaborative learning inside and outside the classroom. Cooperative learning in the undergraduate laboratory. *Journal of Chemical Education* 68 5 , Effects of small-group learning on undergraduates in science, mathematics, engineering, and technology: *Review of Educational Research*, 96 1 , The effect of computer-mediated collaborative learning on solving ill-defined problems. *Educational Technology Research and Development*, 51 1 , Setting up and facilitating group work: Using cooperative learning groups effectively. Retrieved [todaysdate] from <http://>

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Chapter 2 : Cooperative Learning - Success for All Foundation

Number Power: A Cooperative Approach to Mathematics and Social Development: Grade 2 by Laurel Robertson, Shaila Regan, Susie Alldredge The activities in these books encourage cooperative learning on projects which develop students' number sense, mathematical reasoning, and communications skills.

Have you heard about cooperative games? Cooperative games are games based on cooperation rather than competition. There are cooperative games of all kinds for all ages and settings. Cooperative games range from board games to circle games to PE games to digital games and more. They are all based on the principle that it can be just as much fun—well, actually more fun—to play with each other than against each other! In a cooperative game, players work together to win. In a cooperative game, no player is ever eliminated. What is eliminated is fear of failure and the incentive to beat others. A well-designed cooperative game assures that players will experience the heart-felt happiness that comes from being included in a safe and supportive community. Also, a good cooperative game assures that players will practice and value pro-social skills such as sharing, encouraging one another, contributing, and giving and taking. Further, by its very nature, a good cooperative game will clearly demonstrate that cooperating with others is practical and productive. They teach a valuable, pro-social lesson about the benefits of collaboration and they do it in a fun and natural way through direct personal experience.

Cooperative Games in Education Do cooperative games have a role in education? It is easy to see that they do. As described above, cooperative games motivate players to want to cooperate plus they teach the skills needed to cooperate and they help players recognize the value in cooperation versus constant competition. By introducing students to cooperative games, which naturally and effortlessly teach cooperation, the teacher primes students for success in cooperative learning. Thus cooperative games are a sensible and smart way teachers can prepare kids for wonderful cooperative learning, group work, and collaborative project-based learning experiences. Besides paving the way for formal cooperative learning strategies, cooperative games can also be used to teach academic subjects. More and more educational cooperative games are being developed for classroom learning these days, as the concept of cooperative games is beginning to catch on at a large scale. Educational cooperative games combine the pedagogical power of play with the advantages of learning in small groups; thus they tap two major approaches to teaching and learning. With educational cooperative games, students can learn language, math, science or other academic content at the same time that they practice cooperating. The essential role of play in learning is well-documented. For young children especially, play is the primary activity by which learning takes place. Plato said over two thousand years ago: And this is in addition to all the benefits related to cooperation! But we are not finished yet in our summary of the benefits of cooperative games in education. SEL is increasingly recognized as essential education, necessary for the development of the whole child. Clearly, cooperative games, which teach children how and why to get along together, help students build many underlying social-and-emotional competencies. Besides preparing students for cooperative learning, teaching subject area knowledge, and building social-and-emotional competency, cooperative games relate to other areas of education, ranging from sustainability to special education. Indeed the applications of cooperative games to education are too many to discuss in a single blog post. You can check CooperativeGames. However, this introduction to cooperative games in education would be utterly incomplete without discussing one more benefit: Cooperative games literally reduce aggressive behavior both during game play and afterwards too. This fact has been demonstrated in independent University research. The ability of cooperative games to not only increase pro-social skills but also reduce aggression has important implications for school climate. More to the point, because playing cooperative games reduces aggression, cooperative games should be utilized on a wide scale—in every classroom and at different age levels—to prevent bullying. Cooperative Games and Bullying Bullying is a cruel torment which is all too common. Bullying produces moments of knife-sharp suffering during the school day and it can leave dull, aching pain that lasts a lifetime too. Kids who are victims

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of bullying are five times more likely to be depressed compared to their peers. Kids who bully suffer as well. Bullies are at high risk for serious negative consequences including social isolation, poor academic performance and later criminal behavior. Indeed nearly 60 percent of boys classified as bullies in grades six through nine were convicted of at least one crime by the age of 18. Naturally, teachers, parents, and government agencies are alarmed about bullying. Teachers understand that they cannot ignore the potential for bullying to disrupt the classroom and undermine learning. A go-to source for information is StopBullying. Of course, teachers, administrators, and even peers need training in how to respond to full-blown incidents of physical, verbal, and social bullying. However, the important point is that prevention matters as well, and is indeed the most efficient way to address the bullying crisis. Especially when introduced early, these games have great promise. Though this work was not well-circulated, the concept of cooperative games as an alternative to competitive games was first articulated by Lentz and Cornelius. It has seeped slowly through the culture and begun to bloom in diverse forms. He is still at it today! Many cooperative game designers, inspired by these early pioneers, have followed over the past decade or so. What has been lacking until now however is awareness of the strong pedagogical rationale for using cooperative games in education. This article seeks to address that gap. So thank you for reading it and please share if you agree that cooperative games are a pedagogical idea whose time has come! As this article hopefully indicates, there are many robust reasons that cooperative games should be used in education, not the least of which is that they can prevent bullying. It is time we educators discover and share the many benefits of playing together! Further, if you are a teacher or parent responsible for the education of very young children, a resource for using cooperative games to prevent bullying is now available to you. The Cooperative Games Bullying Prevention Program, published in 2011, gives you all the practical knowledge and tools necessary to use this approach. This is the first bullying prevention program based explicitly on cooperative games. The core games used in The Cooperative Games Bullying Prevention Program are the very games that were tested in the University of Nevada study on cooperative games and shown to work. Thus The Cooperative Games Bullying Prevention Program is a solid, research-based approach to preventing bullying with data to back it up. It is also easy to implement, inexpensive, and of course fun! To find out more or purchase the program visit CooperativeGames.com. Finally, to make this all a bit more concrete, here is one of the research-tested, active cooperative games featured in The Cooperative Games Bullying Prevention Program. Give it a try and have some fun! And while your students wiggle and giggle without a care in the world, know that in fact you are bringing them this joyous opportunity because you indeed care so much about the world. May the peaceful power of cooperative play be with you and yours!

Classroom game To Play: In advance, prepare the hearts. You will need half as many hearts as you have children playing the game. On one half of each heart, write a number and on the other half, draw that number of circles or use a different shape or picture besides circles if you like, for example, smiley faces. Cut the hearts in half so one side has the number and the other half has the picture of the circles. Give each child half a heart. Ask the children to skip around the room while you play music. Now, stop the music. Ask each child to match his heart-half with its counterpart. After everyone has found their partner by matching numbers and shapes, have the children trade their halves for a different number. Start the music again, ask the kids to skip around, and find a new partner by making their half hearts whole.

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Chapter 3 : Implementation of Cooperative Learning in Science: A Developmental-cum-Experimental Study

Number power: a cooperative approach to mathematics and social development.. "Developed by the Cooperative Mathematics Project, a program of Developmental.

Research Base Together They Achieve Learning in isolation can pose significant challenges, especially for students coping with the stresses of poverty or English as a second language. Learning should be a social activity. Working in groups, students can accomplish far more than on their own. They have the opportunity to discuss new concepts with peers who have similar levels of understanding. They can support one another, learn to think critically and consider opinions others before reaching a conclusion. Success for All Foundation programs are founded on cooperative learning strategies that enable students to fulfill their potential while having fun along the way. In our partner classrooms, all children benefit from the constant coaching, encouragement and peer feedback. Our curricula emphasize team goals that can only be achieved when everyone is learning and improving. SFA students are motivated to work together to achieve common goals. By helping others, they learn to help themselves. And they take responsibility for their own development.

Cooperative Learning Research Slavin, R. Classroom applications of cooperative learning. Classroom Applications of CL. Instruction based on cooperative learning. Instruction Based on Cooperative Learning 09 24 What makes groupwork work? Using research to inspire practice. CL What Makes Groupwork work. Cooperative learning programs and multicultural education: Issues, policies, and practices. Lessons learned from cooperative learning programs. Journal of Social Issues, 55 4 , Theory, research, and practice 2nd Ed. Effects of a cooperative learning approach in reading and writing on handicapped and non-handicapped students. Elementary School Journal, 95 3 , The cooperative elementary school: American Educational Research Journal, 32 2

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Chapter 4 : Cooperative Games What Are Cooperative Games and How Can They Help Education? - Corv

Number Power: A Cooperative Approach to Mathematics and Social Development Paperback. Be the first to review this item.

Ask an Expert The power of play “ Part 1: Stages of play Play is important work in early childhood. Learn more about how the power of play can help children learn important skills and prepare them for the world. October 6, - Author: Through play, children learn academic skills like math, science, reading, language and literacy. They learn social skills like effective communication, conflict resolution, problem solving and cooperation. Maybe most importantly, they learn about themselves “ they get to know their personalities including their likes and dislikes, strengths and interests. Through play, children learn where they fit in in the world. Researcher Mildred Parten identified these six stages of play that children progress through. Children are relatively still and their play appears scattered. This type of play builds the foundation for the other five stages of play. Unoccupied play looks like babies or young children exploring materials around them without any sort of organization. This stage allows children to practice manipulating materials, mastering their self-control and learning about how the world works. This type of play occurs when children entertain themselves without any other social involvement. Children in solitary play may not notice or acknowledge other children. Adults might worry about children playing alone, but actually solitary play is very normal. When children engage in solitary play, they are able to explore freely, master new personal skills like new motor or cognitive skills, and prepare themselves to play with others. Children who sit back and engagingly watch other children playing, but do not join in are onlookers. The active part of their play is watching others. They learn about the social rules of play and relationships, they explore different ways of playing or using materials and they learn about the world in general. This occurs when children play next to each other, but are not really interacting together. For example, two children may drive cars on the carpet next to each other, but their play does not actually overlap. In this stage, children are not really engaging in a social exchange. Think of this stage like a warm up exercise “ children work side by side on the same activity, practicing skills and learning new methods to engage together. This type of play signifies a shift in the child. Instead of being more focused on the activity or object involved in play, children begin to be more interested in the other players. Associative play allows children to begin practicing what they have observed through onlooker and parallel play. They can start to use their newfound social skills to engage with other children or adults during an activity or exploration. This is play categorized by cooperative efforts between players. Children might adopt group goals, establish rules for play. Ironically, cooperative play often involves a lot of conflict. It is sometimes difficult for young children to share, take turns and negotiate control in these types of play scenarios. You can support children engaged in cooperative play by staying close and helping them learn healthy expression of emotions and teach them problem solving skills. Michigan State University Extension has tips to help you support your child through these six stages of play. Create opportunities for your child to explore. Whether it is pulling out fun new materials to explore, taking your child to a museum or simply walking around the block. Help your child discover new places, materials and people to play with. Hold on to your expectations. Instead of worrying about how you think your child should be playing or what you expect them to do with a certain toy or in a specific situation, let your child decide. When children have control of a situation, they learn to listen to their own cues and promptings, making learning developmentally appropriate for them, and also fun and engaging. Your child might need help learning a new skill or emotional support exploring a new environment, or they may need new ideas and inspiration from their favorite adult. As your child grows and develops, your support can help them reach new heights. Just like adults need education and resources to learn how to be good at their jobs, children need the same support to support their job of playing. Along with practical materials like toys and games, children need encouragement, engagement and lots and lots of time to play. For more information about the purpose of play , play and learning , positive discipline,

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child development, academic success or parenting and life skill development, please visit the Michigan State University Extension website. Other articles in this series.

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Chapter 5 : The Power of Cooperative Learning

Number power: a cooperative approach to mathematics and social development a cooperative approach to mathematics and social development.

Cooperative learning is a term that has been used in education circles for years, but it is one of those terms that never goes out of style. There are many forms that cooperative learning can take, but the simplest definition of cooperative learning is a group of children working together. Cooperative learning can be a powerful tool in the classroom and masterful teachers can use it to accomplish many different academic and social goals. It can be used in almost any subject area and with all students. It has been proved as an effective strategy to use with diverse populations including special needs students, those identified as gifted, and English Language Learners. The benefits, both academic and social, are innumerable and teachers would be wise to look for opportunities to use this tried and true approach. Ways to Group Children When teachers are providing cooperative learning experiences there are several ways that they can group children, depending upon their goals. Teachers can create groups by assigning children of mixed abilities, skills, or interests in the subject area being taught. By creating mixed ability groups, students can support and learn from each other in a true team approach. The children can each bring their unique talents to the problem at hand, while they learn from and support each other. Teachers can group children with similar abilities for projects of problem solving activities. Groups can be assigned similar, but slightly different tasks, designed to raise their level of understanding. Another way to group children is by personality. If there are several children who are very shy and quiet, a teacher may decide to group them together so that they are forced to speak up and participate more than they would if they were paired with a more vocal partner. The opposite could also be true where a teacher would pair a more outgoing child with a quieter one so that there was a child in each group who felt more comfortable in a leadership role. Random grouping is sometimes the simplest way to group children for a cooperative experience. Children who typically do not work together may end up making great partners. Children who do not always get along may become friends. Children who are not usually very vocal may be much more comfortable in a small group as opposed to a large one and may take a very active role in the learning. Children using the Spielgaben during a Cooperative Learning exercise on three dimensional shapes.

Benefits to Cooperative Learning There are many benefits to cooperative learning. Some of the benefits are academic while others are social. Reasons to include cooperative learning exercises include: These opportunities help children learn to work with differing personality styles, learning styles, and approaches. This is a skill that they will need throughout their lives so why not start now? When working with a small group, conflicts are sure to arise. By allowing children to work out their issues in a controlled setting, they can gain the independence and maturity necessary to solve conflicts when they are on their own. Better understanding of concepts: By working together in a small group, children have a greater opportunity to develop true understanding of a concept because of the discourse between group members. This presents a much greater chance for learning material than a whole class discussion where only a few children are heard, and others may not be attending. When working in a small group, their engagement is much higher and therefore so is their chance of mastery. Students who are struggling with a concept can often learn from a peer better than they can from their teachers. Students who already own a concept benefit from even deeper understanding by teaching it to others.

Places to Try Cooperative Learning in Your Curriculum As I previously mentioned, cooperative learning experiences can be incorporated almost anywhere in the curriculum. Below are some ideas: Provide a group of children with a math story where they have to work together to decide how to solve the problem, and then represent it visually with a drawing or manipulatives. Have children work together to create an information piece based on a story they have read. After children read a text, they can work together to retell the story to the rest of the class. They could choose to do a play, a written retelling or an oral one. Have students work together to create a map, brochure, or some type of visual

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presentation describing a concept they have been learning about. Groups of children can share materials to work together on an experiment or lesson, and report back to the rest of the class about their discoveries. Other Ideas for Cooperative Learning Activities: Put a large collection of items out pennies, buttons, etc. Have groups of children work together to decide how to solve a problem that has arisen in the classroom. Have children design a coat of arms for their group which highlights different and important things about each student. Groups research a certain bird, animal, structure, country, etc. They work together to create a presentation and share it with the rest of the class. The ideas for cooperative learning are endless, as are the benefits. The number of studies indicating the benefits of cooperative learning and its effects on retention are impressive and teachers would be wise to incorporate this style into their classroom whenever possible. Whether it is designed as an opportunity for increased learning, interpersonal development, team bonding experiences, or just plain fun, all students will benefit from these activities.

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Chapter 6 : Math Play: How Young Children Approach Math | Scholastic

Number Power, Grade 3: A Cooperative Approach to Mathematics and Social Development (Paperback) Published September 1st by Addison Wesley Publishing Company Paperback, pages.

Students analyze and classify objects based on specific criteria. Categorize based on attributes. Categorize numbers in various ways: Each student studies a part of a topic and then presents his or her information to group teammates. Study classmate preferences on certain topics and construct graphs. Learn algebraic formulas and solve equations together. After each team member numbers off, students discuss the answer to a question. Then, in a large group the teacher calls a specific number and group to answer the questions. Discuss the answer to a mental computation problem. Apply the definition of a rule previously introduced to problems; explain the application of the rule. Round the Table 4. Pass a worksheet with multiplication facts for each member to answer a problem. Pass problems for each member to compute the next step of an algorithm. San Juan Capistrano, CA: Resources for Teacher, Inc. These five elements can be structured to promote team work and collaborative skills. They can be facilitated in various ways, for example, by asking students to be responsible for certain duties e. Roles with specific responsibilities can be assigned to each group member. Examples of roles include materials person, spokesperson, writer, encourages and timekeeper. Roles should be taught and practiced prior to placing students in cooperative groups; students need a good understanding of the responsibilities associated with each role. Groups should contain various ability levels. By limiting group size to four to six students, each member should be able to have an active role and access materials within a reasonable amount of time. Lesson instruction The "lesson instruction" component of cooperative learning refers to the time in which cooperative learning activities occur. Students should engage in cooperative learning activities after they have received direct instruction in the mathematics and collaborative skills objectives targeted for the group activity. Asking students to perform math activities and collaborative skills for which no previous direct instruction has occurred puts students with LD as well as other students at risk for failure and group frustration. Inevitably, the lack of direct instruction prior to cooperative learning may result in numerous questions requesting clarification and assistance. Therefore, "lesson instruction" consists first of direct instruction, and then the cooperative learning activity. Cooperative learning can be used as the "guided practice" time when students engage in tasks to practice introduced skills. Cooperative learning can be used at the onset of math instruction as a means of reviewing skills and concepts or after the presentation of subject matter where new material is practiced within the context of previously taught material. For example, if the math objective is to teach students how to solve story problems using a strategy, then the strategy steps should first be taught directly. Students could then work in a cooperative learning activity that requires the use of the strategy to solve story problems. The teacher must a have students transition quickly after direct instruction, b have activities and materials ready, c monitor student progress in groups, and d reinforce the occurrences of collaborative behaviors. Teachers can conduct such evaluation by a observing students during the cooperative learning activity, b having students complete individual tasks following cooperative learning activities, and c asking students to engage in group processing self-evaluation. Answers to the evaluation questions may suggest further direct instruction in a math skill with some or all of the students. When the cooperative learning activity is finished, teachers may want to administer an individual posttest to determine how well each student has mastered the mathematics content. This is a common form of pupil evaluation that typically yields some type of permanent product, which can then can be graded. The purpose of this evaluation is to ascertain whether students are capable of performing the mathematics objectives independently at mastery level. Students also should be given the opportunity to evaluate their ability to be team players; this is called group processing. Johnson and Johnson recommended that, following any cooperative learning activity, students should have time to discuss how their group performed in completing the math activities. With careful planning, implementation, and evaluation cooperative learning activities can be achieved successfully

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by most students. The next section provides an example of using cooperative learning to teach mathematics. Teaching mathematics using cooperative learning Below is an example of using cooperative learning to teach a math lesson based on the three major components of cooperative learning: The cooperative learning activity in this example is taking place in the general education setting where the general and special education teachers plan and teach cooperative learning math activities collaboratively twice a week. Lesson preparation During "preparation" the cooperative learning math activity is designed; a description of "preparation" activities follows. In this example, the instructional objective for mathematics is: In whole group instruction, the instructional objective will be addressed by reviewing with all students the steps of a story problem-solving strategy that was learned the previous week. Using the strategy, two story problems will be solved by the teachers who will recite the steps and verbalize their thinking processes as they work through the problems. Then, students will solve two story problems with the teachers. Next, students will review cooperative learning role responsibilities and explain ways to encourage and support each other. Rules about sharing also will be reviewed. In the cooperative learning group, "numbered heads" will be used as the activity structure. Students will use their strategy cue cards to solve four story problems. Teachers will facilitate group work and interactions. Time will be allowed for group processing and students when called on by group and number will explain how their group solved a particular story problem. Promote the elements of cooperative learning. One strategy cue card will be distributed to each group, thus necessitating sharing of the card. A posttest will be individually administered containing four story problems to determine if students can solve the story problems independently using their cue cards. The reading level of the story problems will be controlled for different ability levels in the classroom. Identify the roles and groups. The groups will consist of four students; only one student with LD will be a member of each group. Rules - Can Students explain to each other the rules that were taught during direct instruction, which must be applied in the cooperative learning activity? Strategies and Algorithms - Have students learned the strategies and algorithms? Connections - Can students explain how the new information relates to previously mastered math skills and concepts? Lesson instruction Implementation of the math lesson, in this example, requires direct instruction followed by the cooperative learning activity. The instructional steps are described below. Provide an advance organizer. Explain the purpose of the lesson and the instructional and collaborative objectives. Remind students that they worked on a story problem-solving strategy last week and ask for a definition of a strategy. Have students refer to their strategy cue cards and repeat the strategy steps. Ask individual students to recite the steps, then ask students to repeat the steps without referring to the cue card, if possible. Next, model solving a story problem using the strategy cue card and verbalizing the steps. Have students imitate this process solving another problem at their desks. Ask for answers and explanations of how the problem was solved. Explain the cooperative learning activity, using the "numbered heads" structure. Remind students that they can use a cue card to solve their four story problems. Provide directions for transitioning into cooperative learning groups, set a time, distribute materials, and review the task. Once students are in groups, serve as a facilitator by guiding students with questions e. Reinforce groups for demonstrating appropriate collaborative behaviors. Provide time for group processing, and call on students by number and group to provide answers to the story problems. As mentioned earlier in this article, there are three types of evaluation. In this example, the first evaluation can be done during the cooperative learning activity: For instance, evaluation questions like those in Table 1 can be used to determine mastery or potential trouble spots solving story problems. The second evaluation is individual and can be done following the group activity by administering a posttest. Finally, have students evaluate themselves during group processing to determine their abilities with the designated collaborative skills. This evaluation should be shared with the teacher to be sure that teacher and student perceptions of abilities match. Conclusions Cooperative learning is a popular instructional arrangement for teaching mathematics to students both with and without LD. Coupled with direct instruction, cooperative learning holds great promise as a supplement to textbook instruction by providing students with LD opportunities to practice math skills and concepts, reason and problem solve with peers, use mathematical

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language to discuss concepts, and make connections to other skills and disciplines. Carefully constructed lessons, using the "lesson preparation," "lesson instruction," and "lesson evaluation" components can offer students with LD rich learning opportunities in mathematics instruction. References Click the "References" link above to hide these references. Integrating cooperative learning and structured learning: Effective approaches to teaching social skills. Focus on Exceptional Children, 20 9 , Cooperative learning and mathematics. Resources for Teachers, Inc. Rakes, Curriculum-based assessment and programming 3rd ed. Getting along with others: Teaching social effectiveness to children. Mainstreaming and cooperative learning strategies. Exceptional Children, 52 6 ,

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Chapter 7 : Co-operative Problem Solving: Pieces of the Puzzle Approach : blog.quintoapp.com

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The content of this article is largely drawn from an Australian publication by Peter Gould that has been a source of many successful mathematics lessons for both children and student-teachers. See publication details at end of article. It presents a style of problem-solving activity that has the potential to benefit ALL children in a class, both mathematically and socially, and is readily adaptable to most topics in mathematics curricula. What is the Pieces of a Puzzle Approach? To support the approach, a set of essential work rules must be established based on the work of Burns Rules You are responsible for your own work and behaviour You must be willing to help any group member who asks You may only ask the teacher for help if everyone in the group has the same question These rules assist in avoiding some of the pitfalls of co-operative group work. Once the children have had experience with these rules, the situation of one person dominating by collecting all the pieces of information and taking control should not occur. Similarly, a group member should not opt out of the activity and sit back and let the rest of the group solve the problem. The ability of the children to successfully follow the rules will improve with each session, and will be influenced by teacher led discussions about the purpose of each rule. The structure of this approach is intended to provide positive opportunities for: Risk taking - pupils are more likely ask questions of each other and put forward ideas in a small group situation, particularly with Rule 2 in place. Mathematical language development - usually the clues for the tasks are communicated with words. The group needs to negotiate their interpretation of the mathematical vocabulary. They also must talk to each other, listen to others and explain their ideas clearly. Peer coaching - pupils are able to clarify their understanding of mathematical concepts, correct misconceptions and test out ideas during the process of finding a collective solution to the problem. Effective learning - the tasks generally incorporate the manipulation of physical objects to produce a final product, which promotes the linking of verbal knowledge with visual imagery. Mixed ability class teaching - the features listed above combine to make this approach particularly suited to use with mixed ability classes. Every child should be able to make a contribution to the problem solving process, learn from the activity and have received attention from the teacher when needed. Forming the Groups There are, of course, many ways to organise children into groups. Unless the teacher has specific reasons for doing otherwise, a random mix method is best for this type of co-operative problem solving. Random Mix by the Cards Here is one way to achieve a random mix of pupils using a pack of ordinary playing cards. To form seven groups of four children, use all four card suits from one Ace to seven. Shuffle this pack and have each child choose a card. All the sevens form a group, all the sixes form a group and so on. You may want to assign a role to each card suit such as: This type of problem solving activity is well suited to developing and clarifying mathematical ideas that have already been introduced in other lessons. Therefore, in introducing the task to the class, the teacher can make links to previous work. If the mathematical vocabulary contained in the problem is of particular concern, then key terms should be revised. The groups are formed and each child in a group is given one clue card. The teacher must also take care to follow these rules, and not take back responsibility for the task by interfering with the problem-solving processes or offering help before being asked by the whole group. As always, it is advisable to have an extension question ready for a group that finishes before the others. Plenary - It is important for groups to report on their problem-solving processes as well as confirming the correctness of their end product. The teacher can use questions focus on particular issues and highlight points that have been observed during the session. How did your group get started? What caused some difficulty? Which clue did you find most helpful? Did any group do it a different way? What might you do differently next time? Examples of Problems An important advantage of the Pieces of the Puzzle Approach is that teachers can make up their own problems to

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suit whatever topic is appropriate. This is done by working back-wards from the final product such as a model or answer such as a number , and then designing a set of essential clues, plus a couple of extra clues. Make use of any maths resources in the school such as multi-link cubes, pattern blocks, Polydron shapes or other construction materials. A visual focus should be provided, even for number problems, so make use of digit cards, number lines, Hundred Charts etc. It is wise to test the clues out on someone else if possible. It takes a bit of time, but the same problems can be recycled in years to come. Asking children to invent their own problems once they gain some experience is an excellent extension exercise, as well as an interesting assessment opportunity. The following problems are only examples of the sort of tasks that can be done, and should be used as models to generate many more problems. The aim is to deduce the mystery number.