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Cover Page Footnote

I would like to acknowledge my overseas teaching experiences, in particular while teaching middle school mathematics at the American School Foundation in Mexico City, Mexico that gave me the opportunity to teach mathematics and work with such a diverse group of students from around the world. My work there lead me to this research and paper.

Using Cooperative Learning to Teach Mathematics to Help Promising ELL and All Students Develop Social Skills: A Case Study

Abstract:

This paper shares the story of Jung and how a gifted young student in mathematics learns social skills and shares knowledge and helps to improve his own learning of the English language while sharing his understanding of mathematics with others. Students working together in math classrooms all benefit in many ways including language acquisition, problem solving, math achievement, social skills, cultural differences, and a shared sense of community in a classroom, when all working together for a goal in learning mathematics while also learning social skills so to fit in better within society. Cooperative learning plays a critical role today in teaching mathematics and preparing young people how to be successful and fit into society better and get along with each other. This paper shares the story of Jung a young mathematically gifted student who lacks English language mastery and social skills and how his teacher employs cooperative learning with an emphasis on social skills, language acquisition, and problem solving to help this gifted student and all students in the classroom in building community and camaraderie while learning mathematics. Steps and the process for setting up your own classroom to employ cooperative learning are outlined in this paper. An emphasis on social skills is addressed showing what it looks like and what it sounds like as students learn mathematics together.

Keywords:

Cooperative Learning, ELL, Mathematics, Gifted, Social Skills, STEM, Case Study

Introduction

"If you help others, you will be helped, perhaps tomorrow, perhaps in one hundred years, but you will be helped. Nature must pay off the debt...It is a mathematical law and all life is mathematics."

-Gurdjieff

English Language Learners (ELL) who are mathematically promising often to appear to have everything going for them except proficiency in the language to do word problems as sometimes a lacking in social skills to relate to other regular performing students. On the surface, they may appear capable of handling life's difficulties on their own. Often, they perpetuate this myth themselves for they are quick to perceive what is expected of them and perform accordingly, so that even the most perceptive adult may not be aware of how such a very intelligent young person may be feeling (Halsted, 2009). Many times, even the most gifted students' mathematically find it difficult to work in cooperative group settings. As a math teacher, I can remember a few years back when my sixth-grade student, Jung, a very capable ELL student, who liked to work alone a lot, was often very difficult to convince him that working in a cooperative group setting was to his advantage. Jung did well for the most part, and if he didn't, he became quite upset with himself. The purpose of this paper is to provide the reader with a teachers' experiences with a mathematically promising student and the struggle the teacher had to elicit the student in cooperative learning tasks and how to set up your math classroom to employ cooperative learning and to teach social skills. Overall, cooperative learning in mathematics has proven to be very effective to all students learning the subject and improve achievement levels and social skills (Arifin, 2022; Slavin, 1983). Cooperative learning has been around for more than forty years and advocated in the mathematics classroom to be both a strategy for raising mathematics achievement scores and also to help with developing better social skills for the world we now live in as in the past. It is a critical component to classroom instruction today. Furner (2019) found that it is critical that educators address students' dispositions toward math and check for them while teaching so that no student is left behind with math anxiety or disabled by a poor attitude toward the subject.

Research on Cooperative Learning and the Story of Jung

Research findings have shown that many gifted students are often resistant to working in cooperative group settings (Arifin, 2022; Clark, 1988; Cartwright et al.,

1989; Belcastro, 1990; Manurung et al., 2022; Sowell et al., 1990). Often, gifted students and high performing students feel they can complete the task quicker on their own or that they tend to do all the work when asked to work cooperatively. Many times, gifted students do not like to take the time to share their approaches of how to's to the tasks they are asked to do. Hence, for gifted students working independently is more to their advantage and they see no real need to share and interact socially. Jung displayed many of the above characteristics. He would always say, "Why do I need to work in this group anyway? I can do it faster myself and I always end up doing most of the work anyway." Another complaint from Jung was that he always worried about the possibility of something being wrong and then he would get a lower grade because he was doing the work as a group. He felt that cooperative group work would only pull him down. Jung in class and outside of class had few friends, he hung around with many students who spoke his native tongue (Korean) and who also had mathematical promise. His social skills seemed to be lacking and he didn't favor communicating or sharing. He spoke to people with a kind of frankness that often came across as rude or as a know-it-all. Many times, the students didn't like working with Jung anymore then he cared to work with them. As a math teacher I used cooperative learning as a regular approach to teaching math concepts, skills, and review before exams. It was often frustrating as the teacher to help Jung see the value in him working in groups. Every time I planned a cooperative learning lesson, I knew that Jung was going to start saying "can I just do it by myself?" To me it was a battle sometimes, but I knew in the long run we would all win from encouraging Jung to work with his peers in class.

Research from the Nebraska Math and Science Coalition (1995) emphasize the importance for focusing on teaching social skills in cooperative learning situations as much or more than the teaching of academic skills. Students need to be shown what the social skills are and how you do and what each social skill looks like. For example, encouraging or being polite may be social skills that students can work on within a cooperative setting as they carry out their academic tasks. Teachers must process both the social and academic skills after the students have worked on a cooperative task. Much of the research from Nebraska has found that when social skills are taught and practiced an increase in academic performance follows. In Jung's case his academic performance was already in the top 90th percentile, however, his need to have better social skills was evident. Jung had a great deal to share both cognitively and culturally, he needed to develop the social skills that cooperative learning allows him to cultivate. Our society value people being able to cooperate and work together. A person may have all the academic skills necessary to survive and do well in our society, but without the social skills will have a difficult time getting his or her ideas across or to be accepted or fit in.

Much of the research related to cooperative learning in a mathematics class (Johnson, 2009; Slavin, 1983) has found the following: small groups provide a social

support mechanism for the learning of mathematics; cooperative groups offer opportunities for success of all students; mathematics problems can usually be solved in reasonable lengths of time; problems can be solved in many ways allowing students to discuss their methods; students in groups can help one another master basic facts; the field of mathematics is filled with challenging and exciting ideas which merit discussion; small groups foster communication which supports NCTM's *Principles to Actions: Ensuring Mathematical Success for All* (2014) and all the newer state standards; and mathematics offers many opportunities for creative thinking providing for challenging situations for students in groups. Johnson (2009) also contends that cooperative groups should consist of a group of heterogeneous students varying in size from three to four to be most effective. As a math teacher I have found that small groups are best. Small groups allow all students to actively participate as well groups that are heterogeneous can lend themselves in that low ability students are brought up and high ability students are more encouraged to share and learn the social skills to interact better in class and out.

Employing the cooperative learning method is not easy. It is not just putting your students in groups and asking them to solve problems. For Jung cooperative learning meant learning social skills that helped him both socially and academically. Jung learned to share, he learned to discuss, to have patience, to give, to take, to help, and to be helped. Jung told me at the end of the school year that he honestly felt that it helped him to work in cooperative groups. It helped him maintain his friendships and develop new one. Cooperative learning can be used as a tool for the mathematically promising to help them share their ideas and mathematical conjectures with others which can both improve society and the field of mathematics.

In Jung's case at the beginning of the school year he felt that learning was just supposed to be a one-way taking situation, but from a school year of learning to give he has gained more socially than mathematically. His ability to give now after a year of cooperative learning may lead him someday to give a great deal to the field of mathematics. At the end of the school year, all students cooperated, got along, discussed, shared and fit in better when they worked in groups. All students in the classroom really benefit from cooperative learning, not just the low or high ability students.

Benefits and Importance of Cooperative Learning on ELL and Social Skills

There are many benefits to using cooperative learning in our classrooms. Cooperative learning has been a staple as the best practice for teachers most commonly used in classrooms since the 1970's. Teachers everyday use cooperative learning, many not so formally, as they just put students in groups to share, help each other, share, do peer-review, reflection, problem solving, and often a lot which leads to higher order thinking within groups and students.

Azizbek and Sabokhat (2021) found that cooperative learning as an

innovative and effective method for teaching English to gifted youngsters. Camacho-Minuche et al. (2021) in their research found that cooperative language learning elements were effective in enhancing social skills in English classrooms as well. When employing cooperative learning, teachers found that students improved both the level of English as well as social skills, many which are critical for success in our society. Namaziandost et al. (2020) found that the impact of cooperative learning approaches used on the development of EFL learners' improved speaking fluency of ELL students. Vellayan (2021) found in their review of studies on cooperative learning strategy helped to improve ESL students' speaking skills overall. Carlos Torrego-Seijo et al. (2021) found that the effects of cooperative learning on trait emotional intelligence and academic achievement of Spanish primary school students were significant. Students not only improve their academic achievement, but their social and emotional intelligence is also enhanced when students work in cooperative groups together. Mahbib et al. (2017) found and concluded that teachers' perceptions when using cooperative learning methods in the 21st century's aided in improving English proficiency among primary school students. Today most schools and teachers use and advocate using cooperative learning as a best practice for teaching our youth.

McGroarty (1989) found that benefits of cooperative learning arrangements in second language instruction were significant in assisting second language learner's achievement levels. Alghamdy (2019) share ELL learners' reflections when they used cooperative learning in the learning process and found students overall shared successes and positive experiences and frustrations when put into groups or working together. Arunsirot (2021) in a study of cooperative learning approach in ELL classroom found many positive aspects to using cooperative learning with students whose first language is not English. Overall, Jao (2012) found that mathematics classrooms today need to be multicultural classrooms where culturally aware teaching using cooperative learning and other multiple representations approaches when we teach math are critical components for success in Science, Technology, Engineering, and Mathematics (STEM) fields and the global world we now live in.

The “How To’s” of Setting Up Cooperative Learning in Your Mathematics Classroom

As can be seen from all the above literature on cooperative learning in classrooms, it is critical we incorporate this best practice in the teaching of mathematics. So, there are many cooperative learning models. How do we decide how to employ cooperative learning in our classrooms? There are many cooperative learning configurations and models to follow. Many talk a lot about the jigsaw method as one model where each group learns an idea and then they share and put all together so that the puzzle all comes together to make sense. Some of the most important ideas educators need to take into consideration when employing

cooperative learning is that the main reason, we use cooperative learning today in schools is for having our students learning the social skills needed so to function better in our society as adults and young people. So, always when cooperative learning is used in teaching, educators need to make sure students are practicing social skills. Nebraska ETV Network and the Nebraska Mathematics and Science Coalition (1996) and Davidson (2021, 1990) offer some of the best insights to setting up your cooperative learning model in the mathematics classroom. They talk about the idea that four students are better than three, four is best, five is fine, six is too many, two is too few when students work in groups. Also, students need to be assigned groups based on a few criteria like ranking them on a standardized test from low to high and include one high performing, one low performing, and two middle performing students in a group of four. Also consider language learners, often it is helpful to have another student who speaks the language of a low-level English speaker in a group to assist in translation and understanding. Dagoc and Tan (2018) found that the effects of metacognitive scaffolding had an impact on the mathematics performance of Grade 6 students in a cooperative learning classroom. It is important when we group students those students may be mixed by ability and language. Scaffolding and differentiation of instruction are also considerations as teachers group students for cooperative learning mathematics lessons.

Before having students start doing any cooperative learning in a mathematics classroom, it is critical teachers teach the students the social skills they need to practice when working in a group, for example, using a two-foot voice/quiet/inside voice, this social skill can be particularly useful also in helping with classroom management throughout the year. See Figures 1 and 2.

The “How To’s” of Setting Up Your Cooperative Learning Groups

Use Four Key Roles When Employing Cooperative Learning- Speaker, Writer, Timekeeper, Cheerleader/Encourager [Rotate student roles to build leadership skills in all areas, all students are thinkers during the cooperative learning activities]. See Figure 1.

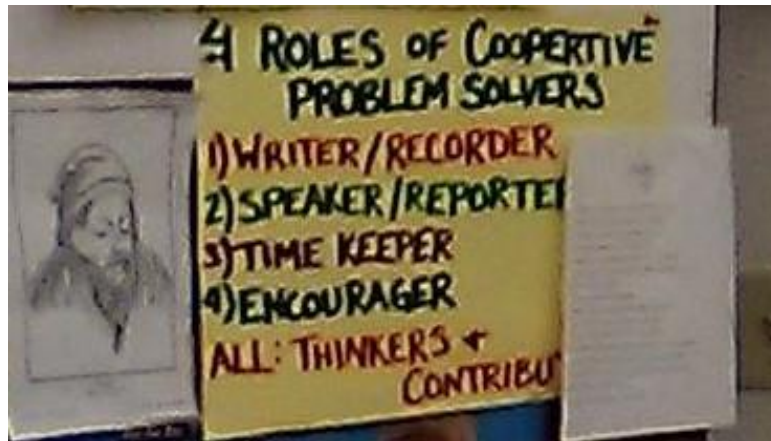


Figure 1. Cooperative Learning Roles

Emphasize Social Skills Each Time Using Cooperative Learning- Like Using a 2-Foot Voice, Listening, Respect, Problem Solving, Encouraging, Consensus building, Disagreeing, Asking for help, Empathy, Shared leadership, etc. (Sinaga, et al. 2022). Even *Indeed*, the job search website, emphasizes these types of social skills as part of being a good employee and as important job skills in being successful as an employee (Indeed, 2022). [All cooperative group work should practice a social skill each time placed in a cooperative group]. See Figure 2.

Create T-Charts-It is important to show the students what each social skill looks Like/What it Sounds Like-Teach Students what each social skill looks like and sounds like as you use cooperative learning. After all the ultimate goal of cooperative learning is for learning to acquire social skills to better fit into society. [Create a T-Chart for each social skill so students practice to review/refer to the skill]. See Figure 2.

Social Skill: Using a 2-Foot Voice Example

What It Looks Like....	What it sounds like....
Huddled, Close together, Whispering	Quiet, Whispers, public space voice

Figure 2. T-Chart for Using a 2-Foot Voice

Mathematics teachers may also play an active role when they have their students working in cooperative groups by going around and listening in and taking notes on what they hear from the students as they work together. It is important teacher teach the students how they need to behave and what to do as they work in groups. Did they ask questions, were they all thinkers, did they practice the social skill and how? Teachers need to collect evidence and present it to the students as they work in groups to train them how they should function as they work together, teaching them the social skills, questioning, critical thinking, etc. Even encourage

students in groups to rate themselves in how they think they did while working on a cooperative task together.

Summary

Cooperative learning has been around for many years in classrooms. It has proven research-based benefits for young people. Student success overall is achieved using cooperative learning, within the subject areas, promoting more higher-order thinking, learning social skills, helping to improve language skills, mutual respect, preparing young people for the workforce and to fit in with society as a whole. Not only does cooperative learning help to improve student achievement and confidence, but it also helps young people with the social skills they need to work together and get along in our society. Cooperative learning is critical for our society and world in advancing and working toward peace and prosperity for all of mankind and a more civilized world. Johnson (2009) found young people are much more educationally and psychologically successful when they use cooperative learning as a part of their instruction and schooling, they learn leadership skills and social interdependence which is critical for all people to interact and get along and function better in society.

Today in our world with so much globalism and students in classrooms from around the world, language barriers often create problems for student with having success for subjects like mathematics. Today STEM is critical as we advance technologically, students need to be well versed in mathematics, but also in the language where they live, problem solving, and getting along with others around them to make important decisions. It is critical today we have students working in groups as they learn mathematics. Students need to learn leadership skills like being a good communicator, writing and speaking well, being encouraging, and keeping track of time to be successful. Students need to have mastery with many social skills to be successful in our society know when to speak quietly in certain situations, communicate, encourage, listen, problem solve and show empathy when needed. Research has shown educators that cooperative learning has proven to increase student achievement scores, but it also teaches us that cooperative groups when done correctly also employing social skills helps young people be better prepared for society, fitting in and working toward making the world a better place.

Mathematics teachers need to use the best practice of cooperative learning not only to help improve student achievement in mathematics, but also prepare our young people for a world where social skills, language, rules, and fitting in and getting along are very important for the success of our countries and society. Cooperative learning is likely one of the most important teaching strategies used in classrooms today to have so many critical impacts on society for all people getting along and understanding one another. Cooperative learning is a critical best practice in teaching mathematics, not only does it help with social skills, gift students, language improvement, and overall achievement, it prepares all students for their

futures in a world where we all need to learn to get along and work toward peace.

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Joseph M. Furner, Ph.D., is a Professor of Mathematics Education and Curriculum and Instruction in the Department of Curriculum and Instruction in the College of Education at Florida Atlantic University in Jupiter, Florida. He received his Bachelor's degree in Mathematics Education from the State University of New York at Oneonta and his Masters and Ph.D. in Curriculum and Instruction and Mathematics Education from the University of Alabama. His scholarly research relates to math anxiety, the implementation of the national and state standards, English language issues as they relate to math instruction, the use of technology in mathematics instruction, math manipulatives, family math, and children's literature in the teaching of mathematics. Dr. Furner is the founding editor of *Mathitudes Online* at: <http://www.coe.fau.edu/centersandprograms/mathitudes/> Dr. Furner is the author of more than 90+ peer-reviewed papers. He has been cited over 2300 times on *Google Scholar* for his research. Dr. Furner has worked as an educator in New York, Florida, Mexico, and Colombia. He is concerned with peace on earth and humans doing more to unite, live in Spirit, and to care for our Mother Earth and each other. He is the author of *Living Well: Caring Enough to Do What's Right*. Dr. Furner currently lives with his family in Florida. He enjoys his job, family, civic and church involvement and the beach. Email Dr. Furner at: jfurner@fau.edu