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Introduction.

It is clear that within education a shift is taking place. How teachers teach and how children learn is changing. Certainly new technology and a transformation in the way humans interact play a key role here (Fan-Ray Kuo, Gwo-Jen Hwang, Szu-Chuang Chen, & Sherry Y. Chen (2012). Furthermore, as society changes so does our need to educate its members. "Many public and private institutions believe there is a growing need for employees who are able to think creatively and solve a wide range of problems (Lavonen, Autio, & Meisalo, 2004, p. 107). Educators are preparing their pupils for a very different world. A global society exists now in which people on different ends of the earth are quickly connected, information is easily obtained on the internet, and the jobs being created require a much different skill set than they did even 30 years ago. However, the point of this is not to explore the reasons, but rather what these changes may mean to education. The days of teachers holding the content and giving it to the students are gone. Now, students must be able to take information they have obtained and create new things. Now, more than ever, we need students to learn how to work together to solve problems. Therefore, implementing collaborative problem solving and possibly using the flipped classroom method to create an opportunity for more group collaboration could be the key to a new, 21st century education.

Methods.

The topic of collaborative problem solving and the use of a flipped classroom has been studied in both qualitative, quantitative, and mixed-method studies. This range of data gives well-rounded insight into not only the possible benefits and drawbacks of collaborative problem solving. It also explains how people collaborate effectively as well as provides intervention frameworks that can teach students how to collaborate.

Most of the research studies were done on a small scale, studying relatively small groups rather than thousands of participants. For example, one study only closely looked at two groups comprised of three male subjects (Barron, 2000). These subjects were observed working in groups and their interactions were analyzed both qualitatively and qualitatively. Though this study provided a unique insight into the interactions by showing transcripts of actual conversation, with regard to the small sample size and the fact that it was only comprised of males was not ideal for generalizability. Most studies, however, chose to include 50 to 100 participants. Most studies also focused on one age group, such as a group of fifth graders (Fan-Ray Kuo, et al., 2012), college students (Eichler & Peebles, 2016) or junior high students (Lee Chien Sing, 1999). Meaning researchers chose to focus on one age group, rather than exploring many age ranges in one study. By doing this, the researches were able to answer more specific research questions since the needs of students vary greatly based on age.

Many of the studies employed the use of treatment groups that received an intervention framework designed to teach effective collaboration and also employed a control group that did not receive the intervention to act as a comparison (Coleman, 1998; Fan-Ray Kuo, et al., 2012; Lavonen, et al., 2004; Rummel & Spada, 2005; Xiaoqing Gu, Shan Chen, Wenbo Zhu, & Lin Lin, 2015). These studies analyzed data similarly as well, using a combination of assessments, surveys, and observation to gage the effectiveness of the intervention. Each research focus sought to explore whether or not students who were given either a type of coaching on collaboration or an intervention were able to work together more effectively. The use of the control group(s) that did not receive help or received minimal help was similar in each study as well.

Most studies used observation as a primary component in assessing collaboration (Barron, 2000; Bjuland, 2004; Coleman, 1998; Lavonen, et al., 2004; Lee Chien Sing, 1999; Rummel & Spada, 2005; Xiaoqing Gu, et al., 2015). Through observation, some studies sought to simply look at how groups worked together and what constitutes effective collaboration. For example, Barron (2000) only studied group interactions without providing any assistance. However, most groups, as described above, received an intervention designed to teach them to work together and then were compared to controls that did not receive assistance. In all but one of the above mentioned studies (Lee Chien Sing, 1999), observational data was assessed both qualitatively and also quantitatively, by assigning numerical values to certain group interactions and then calculating these values. This provided meaningful data to back up observation. In a few cases, this data was also reviewed by an outside party to avoid bias (Eichler & Peebles, 2016; Fan-Ray Kuo, et al., 2012; Rummel & Spada, 2005).

Findings.

Overwhelmingly, each study showed remarkable advantages of collaborative problem solving at the various levels of education, from the primary to college level. For example the studies that focused on providing the intervention frameworks, such as Rummel & Spada (2005) showed that frameworks that taught students how to work together showed increased student satisfaction, better results on project assessments, and more effective communication. No matter what the framework, if students were taught how to work with one another, the collaboration was much more effective. One study even found that if students received the interventions in small, collaborative groups, they learned even more than if they were taught effective ways to collaborate as a large group and then later broken into smaller groups for the task (Fan-Ray Kuo, et al., 2012). This data suggests that simply putting students in groups will not result in either a positive experience or increased understanding. Though some groups are able to work together well without intervention (Barron, 2000; Rummel & Spada, 2005) a wider range of groups will be much more successful not only working together but also learning the material and generating solutions to problems when taught how to collaborate.

Furthermore, the use of surveys and reflections in data collection was nearly universal and showed very similar results. Studies not only sought to understand how groups collaborate effectively, but how individuals in groups perceived their experiences with others and what they learned (Bjuland, 2004). Through these surveys or reflections, students were able to give feedback about their experiences with collaborative problem

solving and flipped classrooms, as well as education in general. For example, a study conducted in Australia using student surveys at the 7th and 11th grade levels found that response to cooperative learning was higher than any other form of learning (with some variances according to grade) and that cooperative learning had a connection to better attitudes towards learning overall (Owens & Barnes, 1982). Similarly, students who participated in an intervention framework group in Xiaoqing Gu, et al. (2015) study rated their experience as having been much better than those who were not taught how to collaborate. Many of these students volunteered to work on projects in other studies as a result of their positive learning experience (Xiaoqing Gu, et al., 2015).

Similar to the use of surveys, a majority of studies used assessments that showed that effective collaborative problem solving leads to deeper understanding of material (Coleman, 1998; Eichler & Peebles, 2016; Fan-Ray Kuo, et al. 2012; Xiaoqing Gu,et al., 2015). For example, when studying photosynthesis, effective collaborative groups that received intervention on how to work well together scored much higher on the assessment and showed a deeper understanding of the subject. Additionally, they produced more advanced work than both individuals and non-treatment groups (Coleman, 1998). Nearly identical success was found with a different framework in a different country as well (Xiaoqing Gu,et al., 2015). So, not only was material understood better as seen in assessment scores, effective collaborative groups generated more solutions to problems in their groups and showed deeper understanding overall.

Finally, studies also reported interesting findings with regards to what traits in a group result in effective collaboration. Bjuland (2004) found that reflection is an important part of effective collaboration, both during the process and after. Also, Barron (2000) found that repetition of ideas by other group members and proper reactions to the ideas of others are also a key component (Barron, 2000). A firm knowledge of content was also found to be necessary as well as a desire to propose multiple solutions (Lavonen, et al., 2004).

Implications for my practices.

First and foremost, research indicates that use of collaborative problem solving is more engaging than traditional content and is preferred by most students (Lavonen, et al., 2004; Owens & Barnes, 1982; Lee Chien Sing, 1999). However, it is not simply a matter of placing in students in groups and having them work together. This can be hit or miss, which was seen in a small group of boys who struggled to collaborate when given no direction (Barron, 2000). Control groups, such as the one in Coleman (1998) also did not show as deep an understanding of material as did groups that were taught how to collaborate in treatment groups. This shows that students need to be taught how to communicate effectively in order to work together and learn with one another. For teachers, these studies can give possible insight into methods that can help teach collaboration, such as the cognitive apprenticeship approach seen in framework in Fan-Ray Kuo, et al., 2012) or the scaffolded framework proposed in the Coleman (1998) study. Similarly, the framework discussed in Xiaoqing Gu, et al. (2015) would also be a good place for teachers to begin when embarking on the challenge of teaching kids how to work with one another well.

As described above, the use of a flipped classroom or a blended classroom has been shown to be effective at both increased student satisfaction as well as grade point improvement as well (Eichler & Peeples, 2016). Knowing this, flipped classroom or blended learning can provide the teacher with more opportunity to use class time for more collaborative group learning because content will be learned at home. This way, information can be put to use in the classroom to solve problems. For a teacher who wants to implement collaborative problem solving in the classroom, the flipped classroom's effectiveness could be the answer (Eichler & Peeples, 2016).

Finally, the importance of looking at teaching through a new lens is important. Studies showed not only the importance of collaboration, but the importance of collaboration with the use of technology. "With the rapid spread and advancement of information technology, schooling not only plays an important role in imparting knowledge to students, but also in cultivating their abilities of collecting data, extracting information from the data, and applying the collected information to deal with upcoming challenges and problems" (Fan-Ray Kuo, et al., 2012, p. 319). The Lee Chien Sing (1999) study done using collaborative problem solving groups working together cross-culturally through the use of the internet and e-mails showed an link between effective problem solving and web-based collaboration. Correspondingly, a study done in a teacher education program purposefully linked collaborative learning with technology education because, as the study argued, the two were interconnected (Lavonen, et al., 2004). This shows that as technology becomes more prevalent in education, not only is use of technology in the classroom important, but there is an important relationship between problem solving and technology that needs to be accounted for as well.

Overall, findings were not surprising. Most recent research and theory holds that collaborative environments not only engage students more deeply in the material but also produce an overall better understanding of that material. Moreover, while some studies, such as the flipped classroom study by Eichler & Peebles (2016), showed that student surveys were similar to that of a traditional classroom, the overall grade point average improved in the blended learning environment. Most students in the research, however, associated effective collaboration with not only better knowledge but better experiences. The evidence reviewed was overwhelmingly in favor of collaborative problem solving in which students are taught how to collaborate effectively (Xiaoqing Gu, et al., 2015)

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