

# Filipino Grade 12 Students Lived Experiences in Group Performance

Jayson L. de Vera <sup>a, a</sup> and Arlyne C. Marasigan, Ph.D. <sup>b, b</sup>

<sup>a</sup>devera.jl@pnu.edu.ph, <sup>b</sup>casperarlyne01@gmail.com

<sup>a</sup>PhD Student, Philippine Normal University, Manila, Philippines

<sup>b</sup>Faculty of Science, Technology, and Mathematics, Philippine Normal University, Taft Avenue, Manila, Philippines

This study is vital to improve the quality of assessment and address the different challenges in performing group activity. Students' lived experiences were assessed using phenomenological approach. Interview was used to gather data. Twenty students participated in the study. Under social relationship, students develop student interactions, make new friends. In contrast, trust with your groupmates in assigning the task, and competition was developed. In the execution of task, majority of the students established good communication with in the group, collaboration and brainstorming which are core idea of cooperative learning. However, there are some free-riding students; procrastination of task, the ideal number of groups, and lack of self-esteem become the barrier of low achieving students to participate in the brainstorming activities. Students become more engage in learning, think critically and learn how to manage time. Performing as a group did effect the student's social relationship, execution of task and students thinking process.

*Keywords:* Assessment, collaborative learning, Group performance, interrelationship, and thinking process.

---

## Introduction

Group Investigation has a strong foundation in John Dewey's philosophy of education where students learned if they are in an environment exposed to inquiry and scientific method applications. This will help students learn by doing and "learn how to learn" (Sharan & Sharan, 1992). Cooperative learning covers a learning environment where we can promote group collaboration and interaction (Slavin, 1991). It is directly opposite with traditional classroom wherein teachers leads and spoon feed the entire discussion (McNeill, 2009; McNeill & Pimentel, 2009). We should promote hands-on activities to strengthen inquiry-based science teaching and learning (Hofstein, Kipnis, & Kind, 2008; Mintzes, Wandersee, & Novak, 2005).

Encouraging students to perform activities which involve critical thinking such as inquiry, investigation and analyzing systems will play a vital role in developing scientific skills and the ability to share their scientific reasoning (Corcoran, Mosher, & Rogat, 2009). The pile of researches on the effect of cooperative learning on students' achievement appears to manage the significance of this study for classroom teaching and knowledge formation (Davidson & Worsham, 1992; Sharan, 1994). It is believed that, if cooperative learning will be properly conducted, a well design student-centered instructional approach will help in promoting problem-solving skills, high-order thinking skills and social skills (Johnson & Johnson, 1991).

Group activity (Sharan & Sharan, 1992, 1999) expects students to form a group, plan and execute their analysis, combine the findings of their individual results, and present their discoveries to the class. The instructor utilizes limited amount of time to give direction and to present the general subject of study and to give a range of resources to enable students to lead their investigations. In group performance, students are thought to become self-regulated students and be responsible of their own learning. Students are required to fully cooperate so that they can have the full grasp of experiences. Intrinsic motivation is really a great help for

the students in realizing the importance of group performance. There are six (6) phases in conducting the activity (Sharan & Sharan, 1992).

Stage 1— The instructors present a multifaceted issue to the entire class

The task presented by the teacher is based from the performance standard presented by DepEd in the curriculum guide of every subjects. These performance standard is parallel with the learning competencies that the students should be able to learn in a particular subject area. The activity is designed in inquiry format. They can used their book as reference and the activity sheet.

Stage 2—Groups Design their experiments.

Students in their own groups helpfully design their performance task. From the guide question presented in activity sheet, students are free to explore the different concepts obtainable in the experiment. The distribution of task will be based upon on their agreement as a group.

Stage 3—Groups execute their design activity.

The students will be asked to prepare materials ahead of time and will execute the procedure on their own. Teacher will just guide them if there are queries that need to be answered. The information that they need to collect will come from the results of the experiment. Together they will discuss, analyze, interpret and summarize to come up with a product.

Stage 4—Groups plan their presentations.

Innovating different ways to present their output is the best way to explain their work. The groups focus on their target competencies. The emphasis is on students gathered data, conclusion and application of concepts. The organization of the presentation will be based from their own logic and understanding.

Stage 5—Groups make their presentations.

Based from their investigation, students will prepare a presentation using Powtoon, an interactive presentation software.

Stage 6— Instructors and understudies assess the tasks.

The work of the students were evaluated using different rubrics to verify the group contribution and collaboration.

Rubric for Assessing Group Members Ability to Participate Effectively as Part of a Team. This rubric enclosed the following questions for peer evaluation.

1. Describe any communication problems within your group, or describe how well members of your group were able to communicate with each other.
2. Did you meet outside of class to establish goals and stay in tune with each other?
3. What worries you the most when working in groups?
4. Did you think you did your fair share?
5. Did others do their fair share?

### **Statement of the problem**

The study aims to determine the Lived experience of the Grade 12 students in group performance.

Specifically the study sought to answer the following questions.

1. What are your specific tasks in performing the science activities?
2. How do you find working with your classmates or member of the group during the experiment/activity?
3. Described your learning experiences during and after the activity.
4. What are the challenges encountered by the students in performing as a group in delivering their performance task?

### **Conceptual Framework**

Group performance can be unpredictable, the result may depend in different situations where students are involved. Feedback changes depending on the difficulty and conditions asked in the group performance.

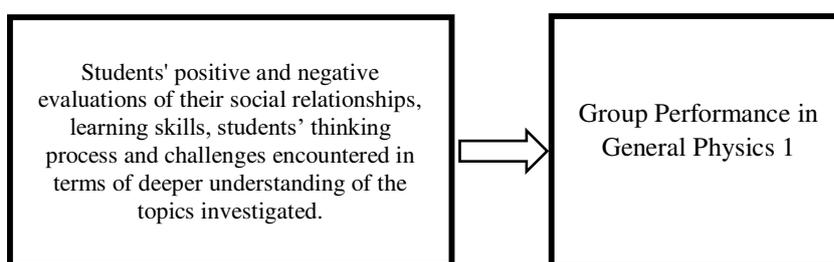


Figure 1. The conceptual framework of the variables.

The conceptual model of this study shown in Figure 1 gives emphasis on the experiences of the students in performing as a group. Their social relationships, learning skills and challenges encountered in terms of deeper understanding of the topic investigated. The study wants to know the personal opinion of students in performing as a group and their personal view point on group performance.

### **Significance of the study**

The project will help the University in devising a framework that will enrich the way of assessing students holistically. This study on assessment will evaluate the students' participation as a group, improve their learning experience, and identify the different gaps in the performance of low and high achievers.

## **Methodology**

### **Research Design**

In this study, students' lived experiences in group performance were assessed using a phenomenological approach. Phenomenology searches for the meaning or essence of an experience rather than measurements or explanations. This sort of technique can help in recognizing the importance behind the human experience as it is identified with a major or prominent aggregate event. (Creswell, 2009). The peculiarity of interest was set up to know how students' experiences can give us ideas on how we can improve our assessment and instructions.

### **Participants and Sampling**

We conducted the research study in Grade 12 General Physics 1 class in the researcher's work place in Caloocan City. The sections are heterogeneous in nature; it is a combination of students with different levels of academic performance. The twenty students participated in the

study who are currently enrolled under STEM strand. Students in all classes studied topics in Classical Mechanics for one semester.

**Data Collection Tools**

Interviewing the participant is very effective strategy in collecting data about the lived experiences (Van den Berg, 2005). We can conduct interviews using semi-structured approach which includes the main focus of the research presented in the previous literature. Data collection is directly tied to analysis that eventually is coded or structured into themes.

**Data Analysis**

Colazzi’s (1978) phenomenology data analysis model highlights conceptual patterns and describes the process of inquiry. The subsequent steps should be followed for the data analysis:

1. Analyzed well the transcribed of the interviews through thorough reading so that we can fully understand the content and thought of the interviewee.
2. From the transcription of the interchanging of questions and answers, classifies the significant statement that pertains to the focus problem.
3. The researchers provide significant meanings of each of the important statements. It is very important to study well the procedure so that meanings will still be evident from the original descriptions.
4. The transcription will be group into clusters and themes will develop. Validation should be done to avoid repetitive themes and discrepancies during the process.
5. The themes will be merge to the paper for thorough description.

**Results and Discussion**

This chapter discussed the theme generated from the interviews conducted among 20 students. Initially it is part into before and after the activity. The summary of the collected responses were grouped into positive and negative responses. Then three main categories emerged as significant: (a) social relationship, (b) execution of task, (c) students thinking process.

**Social Relationship**

According to Alonso, F. et.al. (2015), in order to generate ideas and establish shared relationship among students, group works are one of the best possible way. It is believed that it can improve students’ academic performance. Sharing of learnings and knowledge fain from the activity will enrich the discussion and building of new ideas. Later on, it also establish trust among the group.

Based from the statement of the students, interaction with other students also build confidence, which reflect in statement below:

*“We work together as a group and we help each other to be successful our task and with that, its improves my confidence and now i can interact with others.”*

Finding new friends, and considered as best experience transpired in the next statement.

*“At the end, all the hard works and the efforts are nothing. Because that not all the matters, memories and a lot of fun is the best for all of this works... yes it is the best experience”.*

Negative responses During the Activity	Positive responses During the Activity
All in all, I learned that do not just trust your groupmates because maybe they could forgot or did not do it then its your fault the next day.	I find working with them, fun. I get to know more about my classmates turned to friends. It made our bonds stronger not just a student who

	needs to perform a task but a friend who supports everyone.
It was hard, especially when some of your groupmates are not interested to help. There will be miscommunication in every work that we will do because they don't have any idea how to do it.	We work together as a group and we help each other to be successful our task and with that, its improves my confidence and now I can interact with others.
It's hard sometimes because our other group members is not paying attention on what we are going to do	It is fun and exciting to do our activities together with my classmates, sharing thoughts, ideas, and knowledge. Helping each other. And teaching each other even though there are some instances that we had our misunderstanding especially in our group because of counting of one's cooperation and not considering sick member. I witness it in my groupmate who was being sick but being blamed for not responding accordingly and me myself I experienced it also to be sick but not that highly considered that's why I've got a low grade in individual rating. But then, after all we surpass all of those and we finished all of our task.
it's hard when your groupmates can't appreciate your help, we're trying to help them at any cause but sometimes we can't help them because it's for us	
Working with my classmates is hard not only because of the experiment or task itself but also I have to cope with each and everyone's attitude and feelings in order to come up with a product.	
<b>Negative responses After the Activity</b>	<b>Positive responses After the Activity</b>
Somewhat difficult since I personally prefer working on individual projects. Still, it is fun working with someone else.	It realized that it is easy to work with them because they have a cooperation and there are always participating.
It'd be better to change groups though. After all, we still finished the activities together so it's fine with me. I just hope that everyone cooperate next time.	You will know there capacity on what they can do and not. Along the way you will have new friends.
it's just sir but my other groupmates doesn't appreciate our help	Just like how siblings are, whatever the result was, we always think that we gave our best. And we are happy that at least we tried and did it together in a manner that we could comply in the activity and enjoy the activity itself as well.
I felt happy because we finished it and a little bit irritated because I need to talk to them so they will help to the group.	At the end, all the hard works and the efforts are nothing. because that not all the matters, memories and a lot of fun is the best for all of this works... yes it is the best experience

It was interesting as well because answers tend to just fly around from one person to another.	
--	--

### Execution of Task

Group performance when properly done give a good feedback for everyone. An example of feedback that makes work easier is this:

*“It is easy to achieve or do the activity because there are a lot of us who can contribute a lot of help, we can brainstorm a lot of ideas that can help our work/task become better and it is more fun because I have my members I can joke around with”.*

The statement above is parallel to other statements of students. Cohen, M B. (2010), provide us some evidences based from her study, Based from their activity conducted, students learned if there is sharing of ideas and opinion. It only shows that through group activity they can learn from each other. The experiences that they had allow them to experience and help each other to learn. Below is one of the statement of Cohen’s student:

*“I absolutely learned more from participating in a task group than I would have learned had I just read about it or watched others role play it. I am a “hands-on” learner. I learn from doing. I internalize concept and theories when I have a frame of reference for their meaning. I “get it” better when I’ve “done it.” I have actually experienced and thus have a much better sense of the stages of group development than I did before I took this course, as well as a much better understanding of group norms and roles. I learned that there are aspects of group formation, development, and implementation that are common to all groups”.*

The challenge shows in the statements of the students is the consistency of their groupmates in helping to accomplish the task. Discipline is number one factor to observe in order for the group to work together. This statement shows the lack of discipline of some members, *“Its really hard when it comes to assigning them in to specific task”.*

Negative responses During the Activity	Positive responses During the Activity
I am learning but I am not happy anymore. I am overthinking about graduating with bad health conditions.	It is easy to achieve or do the activity because there are a lot of us who can contribute a lot of help, we can brainstorm a lot of ideas that can help our work/task become better and it is more fun because I have my members I can joke around with.
It's not a few but there are some activities like i don't really know if i have learned something like for example the fire drill evacuation experiment where you use the Pythagorean theorem. I don't really understand and i'm shy to say it.	I find it convenient working with my members during the activities because the task became easy specially when we are all working together,
Its really hard when it comes to assigning them in to specific task.	We do brainstorming in our activities and we help each other to improve ourselves
It's easy to work by group but sometimes it's not good because not all the members are moving or giving interest about the peta	First I learned how to communicate with my team mates to have a good outcome of our activity. Second I learned alot of things on our task. I learned how to do it in proper ways and proper computations.

It made us think that we need to consider our other team members before proceeding to another step/process.	I found out that patience is the key to success. Although I am just a member of the group, I am easily frustrated by all the procrastination and the happy go lucky of some of my groupmates. Pero ps. dahil don natutunan ko po na dapat irespeto parin po natin ang bawat isa at kapag may sasabihin na suggestion apat maging magalang parin.
In the first activity, I find it fun to be working with such competitive groupmates. They really wanted to score as the highest. Though, I'm guilty of that too. However, in the second activity, it was a bit hard since only half of the group took action. There were little actions from the other half of the group, but it was still hard since not all of us worked together as a team.	It is very much effective because we help each other grow and be the best version of an individual that we can be.
I find it difficult because some members are just ignoring our group chat but fortunately, they cooperate more in school.	We were so relieved after the activity, because we finish it after all the hard words we've done. We also forget the miscommunications we had, because we all know that we are just crammed that time.
Even though sometimes we are cramming, we still manage to finish our given tasks.	I find it good because we all know that we did our best. Sometimes we forgot to do some things but we always ended up finishing it because of team work.
It was actually hard because there are some members who don't give enough contributions to the group.	I'm happy that we finished all of these activities despite of too much works from other subjects and I'm thankful also that they are my groupmates because without them, i wouldn't have as good grades as i have right now.
some of them disappear when answering papers haha	I learned that all the activities cannot be done when only one student is working, we should be responsible and inductive when doing such tasks given to us.
It is kind a exhausting but well I can't do anything about it.	
Tolerating them is not a part of my vocabulary.	

### Students thinking process

Developing problem solving skills cannot just achieved through remembering the details, but instead through investigation, draw some reasons and simply organize information; this is the way on how we can integrate knowledge into understanding (Miller et al., 2010). Vygotsky (1962) also examined how socialization made an impact in the learning development. He mentioned that in order to assimilate learning experiences, there should be a face to face interaction with their teachers, classmates and others. This will help in developing an

atmosphere of conducive learning. Also, Positive results was verified by the study undertaken. Students agree that group performance can help the thinking process of each individual:

*“Working with my fellow groupmates made the activities or performances more exciting and much engaging to me to learn the lessons connected to the said activities”.*

*“Since we all cooperate and get to discuss our insights on the topic we learned a lot of things”.*

*“I learned that sometimes we also need to limit ourselves. Like, if we actually know what to do on the next step, we should always ask for some opinions of our groupmates because we were grouped so that we can help each other, not to compete with our groupmates”.*

Negative responses During the Activity	Positive responses During the Activity
okay lang pero mas maaintindihan kung mas naituro.	As a group, we perform our experiment/activity/performance task by having a teamwork. It is because we believe that having a teamwork while doing our activities may help us to perform it perfectly.
I can understand how the physics behind the activities work. Yet when it comes to written output and computations, I somehow get a little difficulty in those because I am quite of a slow learner and need time to understand the whole concept of the lesson.	Working with my fellow groupmates made the activities or performances more exciting and much engaging to me to learn the lessons connected to the said activities.
Sometimes I feel like a burden, because I'm not that good in handling my emotions. Whenever something happens that changes my mood, I don't function the way I am. But working with them helps me to learn my limitations, and know what to work out, and improve in me.	When I'm working with my classmates i feel thrilled because most of my classmates has their own suggestions and they were good thinking what to do. So sometimes I'm afraid to say what I have thinking. Working with my class mates is a great experience even though we are always not serious working our activities we always finished it in time. I learned how to communicate with my classmates and to other people and my shyness has been decrease because of them.
	My vocabulary and my knowledge expand
	Doing the activities is fun. Sometimes, I realize that my pre-existing knowledge is wrong.
	Since we all cooperate and get to discuss our insights on the topic we learned a lot of things.
	Our strength and weaknesses were highlighted during the activity which showcased our full capabilities. It also encouraged us to help each other to achieve our goals.

I found it both easy and difficult. For we have different opinions and different minds. Combining it together is a lot of work. But disseminating the task are far off easier than letting them understand my point of view regarding the lessons.	I find it really interactive working with my classmates or member of the group because as the experiment was performed, our group became close and we were so happy because we finished the activity on time. And after that, we were so excited about the next experiment that will be given by the professor
It is really up to both of you. Its fun to work with your partner but sometimes i feel like he just chilling when we need to think of the answers right away. I also think that hes not that serious with hes answers.	Masaya po kasi ang damping realizations na umuulan sa utak po namin. Komportable at magaan sa feeling kasi maayos at hindi mabigat/awkward yung atmosphere. Damang dama ang pakiramdam ng unity.
things in science especially physics that I often overlook or don't analyze carefully	My vocabulary and knowledge enhanced
	It is easy to learn when you help each other.
	Since it was an activity, I firsthand learned what our lessons were all about. The Law of the Inertia waa present in the first activity, while the Law of Acceleration and the Law of Interaction were seen in the second activity.

### Summary

Group performance may give rise to different problems and good impact to students who experienced this method of teaching. Under social relationship, it is evident that students develop student interactions, create new friends. In contrast, trust with your group mates in assigning the task, and too competitive atmosphere was being developed.

In the execution of task, majority of the students established good communication with in the group, teamwork, collaboration and brainstorming which are core idea of cooperative learning. However, there are some free-riding students; procrastination of task, the ideal number of groups, and lack of self-esteem become the barrier of low achieving students to participate in the brainstorming activities.

Students become more engage in learning, think critically and learn how to manage time. They were able exceed their own capacity to learn. In spite of the different good points of group performance there are still students who want to learn in traditional concept of teaching like whole-class discussion. Performing as a group did effect the student's social relationship, execution of task and students thinking process.

### Conclusion and Recommendations

Based on the findings and discussions, the researchers conclude that:

In a group performance, students become responsible with the task assigned to them. Being held as accountable with the group grades gives a stigma that if they failed to perform their task the whole group is affected. Task may differ from bringing of materials, leader, assistant in the group task, presenter, PowToon (animated presentation of data and results) every performance. It reflects that there is no monopoly of task in every group. Being grouped together with friends helped a lot to improved Social interaction, they are not difficult to talked with and give opinions. Majority of the responses of every learners showed that working as a group really helps in establishing a good rapport and helps in developing new friendship. According to the students, they were able to develop cooperation and teamwork. Cooperative learning was

evident in every task performed by the students. We can verify this with the rubrics presented in the early stage of the research. Students become more engaged in learning, think critically and learn how to manage time. They were able to exceed their own capacity to learn. Students described their learning experience as “enjoyable,” “exciting,” “good,” or “effective.” Students shared that experiential learning is also a good way to learn new things, much more if they will do it by themselves. They were able to try and execute the task on their own and that it was “much more effective than the traditional way of teaching.”

Students are familiar with different cooperative learning styles but the difficult part is allowing them to think and investigate on their own. The very concept of inquiry approach is not yet fully grasped by the students. They are having difficulty in stating hypothesis of the investigation process. They also have weak points in generating queries, they lean on the guide questions posted in the activity sheets. These issues can be addressed one by one through the proper implementation, training and exposure to this type of teaching strategy.

Based on the conclusion above, the researcher would like to recommend some points as follows:

1. Too much familiarity with classmates might affect the distribution of task. It should be considered that learning shouldn't be taken for granted because of friendship. Concern and motivation to learn should be evident at all times.
2. In spite of the positive feedback of the students regarding their performance it is also good to closely monitor the performance of the students while having the group activity. This is to ensure that there are no students behind. Free-riding students should be discouraged.
3. Group performance which is inclined in an inquiry approach of learning requires time for student's assessment and evaluation. To make it more effective, the teacher should learn more about the strategy and dissect even the small details of it. Preparation of materials should be planned ahead of time. Though the implementation of the learning approach is not fully monitored, science teachers should religiously follow the Science curriculum framework mandated by the Department of Education.

## References

- Ali Abdi (2014). The Effect of Inquiry-based Learning Method on Students' Academic Achievement in Science Course. *Universal Journal of Educational Research*, 2 , 37 - 41. doi: 10.13189/ujer.2014.020104.
- Alonso, F., Manrique, D., Martínez, L., & Viñes, J. M. (2015). Study of the Influence of Social Relationships among Students on Knowledge Building Using a Moderately Constructivist Learning Model. *Journal of Educational Computing Research*, 51(4), 417–439. doi:10.2190/ec.51.4.c
- Andrade, Heidi & Wang, Xiaolei & Du, Ying & Akawi, Robin. (2009). Rubric-Referenced Self-Assessment and Self-Efficacy for Writing. *Journal of Educational Research - J EDUC RES*. 102. 287-302. 10.3200/JOER.102.4.287-302.
- Areepattamannil, S. (2012). Effects of Inquiry-Based Science Instruction on Science Achievement and Interest in Science: Evidence from Qatar. *The Journal of Educational Research*, 105(2), 134–146. doi:10.1080/00220671.2010.533717
- Cohen, M B. (2010) Using Student Task Groups to Teach Group Process and Development, *Social Work with Groups*, 34:1, 51-60, DOI: 10.1080/01609513.2010.503384
- Dewey, J. (1916). *Democracy and education: An introduction to the philosophy of education*. New York: Macmillan.
- Elisha Hall, Weiwen Chai & Julie A. Albrecht (2016) A Qualitative Phenomenological Exploration of Teachers' Experience With Nutrition Education, *American Journal of Health Education*, 47:3, 136-148, DOI: [10.1080/19325037.2016.1157532](https://doi.org/10.1080/19325037.2016.1157532)

- Hurst, B., Wallace, R., & Nixon, S. B. (2013). The Impact of Social Interaction on Student Learning. *Reading Horizons*, 52 (4). Retrieved from [https://scholarworks.wmich.edu/reading\\_horizons/vol52/iss4/5](https://scholarworks.wmich.edu/reading_horizons/vol52/iss4/5)
- Ivy Geok Chin Tan, Shlomo Sharan & Christine Kim Eng Lee (2007) Group Investigation Effects on Achievement, Motivation, and Perceptions of Students in Singapore, *The Journal of Educational Research*, 100:3, 142-154, DOI: [10.3200/JOER.100.3.142-154](https://doi.org/10.3200/JOER.100.3.142-154)
- Tan, I. G.-C., Sharan, S., & Lee, C. K.-E. (2006). *Group Investigation and student learning: An experiment in Singapore schools*. Singapore: Marshall Cavendish.
- Johnson, D. W., & Johnson, F. P. (2006). *Joining together: Group theory and group skills*. Boston: Allyn & Bacon.
- Johnson, D. W., Johnson, R. T., & Stanne, M. B. (2001). *Cooperative learning methods: A meta-analysis*. Retried March 21, 2008 from <http://www.clcrc.com/pages/cl-methods.html>
- Lin Zhang. (2016) Is Inquiry-Based Science Teaching Worth the Effort?. *Science & Education* 25:7-8, pages 897-915.
- Mantik, O., & Choi, H. J. (2017). The effect of scaffolded think-group-share learning on indonesian elementary schooler satisfaction and learning achievement in english classes. *International Electronic Journal of Elementary Education*, 10(2), 175-183. doi:<http://dx.doi.org/10.26822/iejee.2017236113>
- McNair, M. (2006). *Cooperative learning in the elementary classroom: A qualitative study in two settings, a private school and a public school* (Order No. 3209858). Available from ProQuest Dissertations & Theses Global. (304912357). Retrieved from <https://search.proquest.com/docview/304912357?accountid=173015>
- Mitchell, M. G., Montgomery, H., Holder, M., & Stuart, D. (2008). Group investigation as a cooperative learning strategy: An integrated analysis of the literature. *Alberta Journal of Educational Research*, 54(4), 388-395. Retrieved from <https://search.proquest.com/docview/228629901?accountid=173015>
- Maxwell, D. O., Lambeth, D. T., & Cox, J. T. (2015, June). Effects of using inquiry-based learning on science achievement for fifth-grade students. In *Asia-Pacific Forum on Science Learning & Teaching* (Vol. 16, No. 1).
- National Academies of Sciences, Engineering, and Medicine. 2017. *Seeing Students Learn Science: Integrating Assessment and Instruction in the Classroom*. Washington, DC: The National Academies Press. doi: 10.17226/23548.
- National Academies of Sciences, Engineering, and Medicine. 2018. *Open Science by Design: Realizing a Vision for 21st Century Research*. Washington, DC: The National Academies Press. doi: <https://doi.org/10.17226/25116>.
- National Academies of Sciences, Engineering, and Medicine. 2015. *Science Teachers' Learning: Enhancing Opportunities, Creating Supportive Contexts*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/21836>.
- National Academies of Sciences, Engineering, and Medicine. 2018. *Open Science by Design: Realizing a Vision for 21st Century Research*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/25116>.
- National Academies of Sciences, Engineering, and Medicine. 2015. *Science Teachers' Learning: Enhancing Opportunities, Creating Supportive Contexts*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/21836>.
- National Research Council. 2005. *How Students Learn: Science in the Classroom*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/11102>.
- Oh, P. S. (2003). *Changes in science classrooms resulting from collaborative action research initiatives* (Order No. 3114384). Available from ProQuest Dissertations & Theses Global. (305335413). Retrieved from <https://search.proquest.com/docview/305335413?accountid=173015>
- Randall, Jennifer & Engelhard, George. (2009). Differences Between Teachers' Grading Practices in Elementary and Middle Schools. *Journal of Educational Research - J EDUC RES*. 102. 175-186. 10.3200/JOER.102.3.175-186.

- Sharan, S. (1980). Cooperative learning in small groups: Recent methods and effects on achievement, attitudes and ethnic relations. *Review of Educational Research*, 50, 241-271.
- Sharan, Y., & Sharan, S. (1992). *Expanding cooperative learning through Group Investigation*. Colchester, VT: Teachers College Press.
- Slavin, R.E. (1995). *Cooperative learning: Theory, research, and practice* (2<sup>nd</sup> ed.). Boston: Allyn and Bacon.
- Slavin, R. E. (1983). *Cooperative learning*. New York: Longman.
- Sharan, S., & Shaulov, A. (1990). Cooperative learning, motivation to learn and academic achievement. In S. Sharan (Ed.), *Cooperative learning: Theory and research* (pp. 173–202). New York: Praeger.
- Sharan, Y., & Sharan, S. (1992). *Expanding cooperative learning through group investigation*. New York: Teachers' College Press.
- Sharan, Y., & Sharan, S. (1999). Group investigation in the cooperative classroom. In S. Sharan (Ed.), *Handbook of cooperative learning methods* (2nd ed., pp. 97–114). Westport, CT: Greenwood
- Tan, I. G. C. (2004). *Effects of cooperative learning with group investigation on secondary students' achievement, motivation and perceptions* (Doctoral dissertation).  
Oh, P. S. (2003). *Changes in science classrooms resulting from collaborative Action Research initiatives*.
- Tan, I. G.-C., Sharan, S., & Lee, C. K.-E. (2006). *Group Investigation and student learning: An experiment in Singapore schools*. Singapore: Marshall Cavendish.
- Tsoi, M. F., Goh, N. K., & Chia, L. S. (2004). Using group investigation for chemistry in teacher education. *Asia - Pacific Forum on Science Learning and Teaching*, 5(1), 1-12. Retrieved from <https://search.proquest.com/docview/1956033424?accountid=173015>