

HOW DIFFERENTIATED GROUPS  
AFFECT FIFTH GRADE SCIENCE STUDENTS

by

Ryan Carlton Foley

A professional paper submitted in partial fulfillment  
of the requirements for the degree

of

Masters of Science

in

Science Education

MONTANA STATE UNIVERSITY  
Bozeman, Montana

July 2012

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Ryan Carlton Foley

July 2012

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## ABSTRACT

This study is a description of an action research project conducted by a fifth grade teacher in order to improve collaborative work during science investigations in a setting of a high-needs, high-diversity classroom. Treatments for the study included complex instruction, flexible grouping, and team-building exercises. Research spanned 20 weeks between two classes of fifth grade students with a combined population of 95% free and reduced lunch eligible. Data collection included triangulated quantitative and qualitative measures including Likert-style student peer reviews, attitude surveys, pre and post student interviews, and teacher observations all used for analysis purposes. Results showed that when using prescriptive treatments tailored to students' multiple intelligence, students showed increased engagement during science lab times.

Keywords: multiple intelligence, complex instruction, engagement, collaboration

MANUSCRIPT OPTION

Contribution of Authors and Co-Authors

Author: Ryan C. Foley

Contributions: Conceived the study, collected and analyzed the output data, and wrote the manuscript.

Co-Author: Walter Woolbaugh

Contributions: Assisted with the study design and discussed the results and implications and edited the manuscript at all stages.

MANUSCRIPT INFORMATION PAGE

Ryan C. Foley, Walter Woolbaugh

Journal Name: Elementary Science Education

Status of Manuscript:

Prepared for submission to a peer-reviewed journal

Officially submitted to a peer-reviewed journal

Accepted by a peer-reviewed journal

Published in a peer-reviewed journal

Published by Elementary Science Education

Submitted July 20, 2012

## INTRODUCTION AND BACKGROUND

Collaboration between student lab groups has been a strategy used by science teachers, and ways of forming these groups is always a subject of debate. This study took a qualitative and quantitative approach to forming these groups. The study was in a Title One school with a population of 95% free and reduced lunch, with 91% eating free. In this school, trends in off-task behavior and student confrontations during science investigations were found in a fifth grade classroom. Jensen (2009) stated that chronic socioeconomic deprivation deters self-determination and undermines self-efficacy. Furthermore, children raised in poverty are more likely to display acting out behaviors, impulsivity, a more limited range in social responses, and less empathy for other's misfortunes (Jensen, 2009). These "misbehaviors" catalyzed a sixth-year teacher to pursue solutions to problems found during collaborative work. Two classes were studied, both shared diversity and the evidence of poverty. Combined classes, 24/33 (73%) of the students were Native American, 7/33 (21%) Caucasian, 1/33 (3%) African American and 1/33 (3%) Filipino. Of 33 students, 31 (94%) qualified for free-and-reduced lunch. The persistence of observable problems lead to an action research project focused on answering questions of how to improve group work during classroom science investigations; and by doing so advancing student engagement. For 20 weeks, the teacher prescribed specific treatments aimed at differentiating collaborative groups and building equity through team-building exercises.

Previous research showed strong results when using a treatment of differentiating the way students are grouped using learner profiles through complex instruction, a flexible grouping strategy (Castle, Deniz, & Tortora, 2005; Colannino, Hoyt, & Murray,

2004). Complex instruction implores teachers to use students as resources in cooperative learning, each providing unique strengths found through their learner profile (Cohen, Lotan, Scarloss, & Arellano, 1999). Tomlinson (2005) defined learning profile as a way an individual best learns. A learning profile encompasses student's preferences in environment, groupings, and different learning styles, including the identifiable and malleable intelligences defined by Howard Gardner (1983). Differentiating using learner profiles regards each student as valuable and equitable parts of their group, each providing unique strengths that are viewed as necessary parts of a whole (Cohen et al., 1999). This study was an example of where students' abilities were seen as valuable and necessary for completing cooperative tasks.

## CONCEPTUAL FRAMEWORK

Dynamics, relationships, and learning abilities are factors that directly affect successful group work. The success of collaborative investigations largely hinges on equitable grouping, where each student is a valued member. As students work together, it is clear to see how their dynamics affect performance. Certainly there are success and failures, and consistent and inconsistent behaviors that propagate difficulties within groups.

The idea that social collaboration facilitates learning underpins the theoretical framework. Vygotsky (1978) argued that social interaction benefits cognitive development. Lotan (2003) argued that collaboration seeds itself in group-worthy tasks that foster interdependence amongst members of a group. Interdependence is a cornerstone in cooperative learning. Interdependence allocates individual portions of

work, information, or materials needed to complete a task, thus forming a reliance on each member for task completion (Johnson & Johnson, 1994). As a result, self-esteem is promoted when students begin to encourage each other's efforts to accomplish group-worthy tasks (Johnson & Johnson, 1994). Lotan (2006) described equitable classrooms as a place where students and teacher recognize abilities critical to successful completion of learning tasks. Johnson and Johnson (1994) complemented Lotan's work, succinctly outlining elements of cooperative learning and highlighting the importance of effective group work through "... constructive relationships and positive attitudes among heterogeneous students" (p. 7). Both authors stressed the importance of individual competence and its role in group work, furthering the importance of equitable groups. In an equitable class, all students are valued, recognized, and are contributing members. "The more students care about each other, the harder they will work to achieve mutual learning points" (Johnson & Johnson, 1994, p. 9).

### Equitable Grouping

Finding the right balance of contributing members in groups is a difficult task. In heterogeneous groups, students maximize their learning time when placed according to their performance levels (Gregory & Chapman, 2002). Cohen (1994) stated that in heterogeneous classrooms, students of varied ability become resources. When students are perceived as valuable, they are more likely to engage in group work and begin to see themselves as important members of the group. Contrarily, Cohen (1994) argued students participate less when perceived as less competent and having low status (as cited by Lotan, 2006, p. 7).

Cohen's (Cohen et al., 1999) work suggested implementing the Complex Instruction (CI) treatment to highlight all learner and intellectual abilities. Complex Instruction includes two strategies: the multiple-abilities treatment and assigning competence to low status-students (Cohen, 1994). In a CI classroom, teachers design learning tasks that draw upon intellectual strengths of each student in collaborative groups (Tomlinson, 2005).

The multiple abilities treatment asks teachers to convince students that many different intellectual abilities are necessary for group-work tasks (Cohen, 1994). This treatment highlights learning profiles- the best way an individual learns, to promote student and group success (Tomlinson, 2005). One way to differentiate using learner profiles is through Gardner's work of multiple intelligences (Gardner, 1983). Tomlinson (2005) stated that Gardner identified eight intelligences: verbal linguistic, logical mathematical, visual spatial, musical rhythmic, bodily kinesthetic, interpersonal, intrapersonal, and naturalistic (as cited in Gardner, 1993). By implementing the multiple abilities treatment, students recognize that their intellectual abilities and contributions are necessary for success.

Assigning competence is the second strategy under the CI umbrella. Assigning competence is a public statement designed to recognize an intellectual contribution a student makes (Cohen et al., 1999). Designed to lift students of low-status up, assigning competence promotes the relevance of an individual amongst his/her peers. By doing so, groups will begin to raise their expectations for competence for the individual (Cohen et al., 1999). This is a powerful strategy used in classrooms, where some students often feel less valued.

Flexible grouping, a procedure where student's autonomy is matched to a task, provides a similar avenue to differentiate group work. Tomlinson (2005) argued by using flexible grouping, students are able to be part of multiple groups in order to match tasks to student readiness, interest, or learning style (profile). A benefit from flexible grouping is the elimination of "pegging" students as advanced or struggling, thus promoting equitable competence to each student (Tomlinson, 2005). The constructs of flexible grouping are less formulaic and prescriptive, and depend on the observations and recommendations of the teacher. Gregory and Chapman (2002) argued that optimal instructional time comes when student performance levels determine membership within groups. Furthermore, they expanded upon the needs of the group: "need ample space, clear directions and procedures, rules and guidelines established, individual roles assigned for group responsibilities, a time frame for on-task work, and to tap into all members strengths" (Gregory & Chapman, 2002, p. 70). Flexible grouping works intrinsically with complex instruction, complementing and strengthening not only group work, but also confidence and self-competence of each individual. For the purpose of this research, complex instruction served as the conduit to which flexible grouping and its methodology of grouping students based on learner profile was used.

The methodologies behind complex instruction and flexible grouping provided scaffolding and credibility to the goals of the action research. A case study (Colannino et al., 2004) highlighted the efforts of a teacher, Noreen Colannino, and her work on differentiating lab groups using multiple intelligences in hopes of improving lab quality and timely completion. She grouped her students using four intelligences: logical-mathematical, linguistic, interpersonal, and naturalistic intelligence. Colannino (2004)

implemented the treatment alternating weeks for a school year. The findings of her work showed (Colannino, Hoyt, and Murray, 2004):

Analysis of results of 10 lab reports revealed noticeable differences between the random groups and the intelligence groups. In the random groups, from the total of a 160 lab reports, only 77 were turned in on time (average of 48 percent of the reports). In the multiple intelligence groups, from a total of 160 lab reports, 132 were turned in on time (average of 82 percent on the reports). Additionally, random groups received an average grade of 64 percent while multiple intelligence groups received an average of 74 percent in the same period. (p. 47).

The results of the yearlong study revealed marked improvement with the multiple intelligences groups.

A second study (Castle et al., 2005) showed academic improvement in a high-needs environment when implementing flexible grouping. This was a five-year study implemented in Silver Lane Elementary School (61% free and reduced lunch) to track a school-wide flexible grouping initiative and student achievement. The results of the study revealed that when using flexible grouping, student mastery achievement in literacy, grades 2-6, increased in 16 of 19 over-time comparisons. Furthermore, increases in mastery ranged from 10% to 57% (Castle et al., 2005). Students were assessed using standardized-state tests and district writing assessments. Perhaps an equally impressive finding was improved confidence levels in below-goal learners (Castle et al., 2005).

These findings were taken from non-transient students (students who had been in school at least three consecutive years). The study accredited improvement to flexible grouping and the notation of particular learning needs, and the ability to keep students engaged

during instructional tasks (Castle et al., 2005). Teachers of Silver Lane Elementary implemented observations and interviews as part of the study. The fluid nature of flexible grouping requires continual assessment to ensure student achievement, making observations and student interviews important assessment tools.

Group dynamics act as a dependent variable to group success. Kagan (2009) argued when students communicate well, have common goals, and know how to work together, they build strong team identities. Furthermore, Kagan (2009) provided a wealth of team-building activities based on its five aims: getting acquainted, team identity, mutual support, valuing differences, and developing synergy. A non-published study (Olsen, 2009) cited the importance of team-building activities in conjunction with group work. Olsen argued that students enjoy team-building activities as a tool for getting to know one another.

The research has shown sound treatments of complex instruction, through which flexible grouping is used, and team building strategies. Each of these treatments inherently builds confidence and structures learning to the abilities of individual students, aligning itself with the framework of cooperative learning. Gardner (1996) stated if we recognize multiple intelligences, we reach more students, giving them more opportunities to demonstrate their understandings. Using strategies that promote competence and value intellectual abilities provided avenues to reach in part the goals of this action research project.

## METHODOLOGY

### Non-Treatment/Treatment

Special attention was dedicated to noticing differences between periods where students were grouped randomly and periods where groupings formed using student's learning strengths. Throughout the research, students were placed into collaborative working groups for science investigations two different ways. Four cycles of research were conducted and the first and third cycles of groupings marked the non-treatment periods, characterized by randomly selected three-member groups. During the second and final cycles, complex instruction via multiple intelligence strengths delineated groupings, marking the treatment periods. Each cycle lasted approximately five weeks including three to four different investigations tailored to specific scientific themes. To achieve this grouping, students completed a Multiple Intelligence Survey Assessment using an online format suitable for fifth grade readers (BGFL Multiple Intelligences, 2012). Each student's eight learning styles results were printed/recorded and used for role assignments during the multiple abilities treatment. Students with *interpersonal* strength fit into the facilitator role, materials getters included *kinesthetic* learners, and the recorder/observer matched students with *visual*, *naturalistic*, and *linguistic* intelligences. These roles were adapted from the Full Option Science System recommendations of: getter, starter, and recorder (FOSS, 2005). Groupings did not remain static, yet shifted with different thematic investigations, allowing students to work with multiple partners. Although partners changed, the students' strength-paired role did not.

#### Data Sources

Data was collected over 20 weeks in which 4 alternated cycles of treatment/ non-treatment occurred covering four FOSS subthemes each including three to four lab investigations. Qualitative measures included interviewing a random stratified selection

of 6 (18%) students at midpoint and post treatment. Quantitative measures included Likert-style peer reviews (Appendix A) and pre/post attitude surveys (Appendix B) administered per research cycle. Ongoing instructor observations and journaling provided further qualitative descriptions.

This study sought to increase student engagement using prescriptive strategies while also evaluating its precipitated effects on the teacher. The framework of this study was structured around classroom action research and its intrinsic spiraling nature of reflection, acting, and evaluating (Hendricks, 2009; Mills, 2011). A varied and triangulated set of authentic qualitative and quantitative assessments helped corroborate data (Lotan, 2006).

## DATA AND ANALYSIS

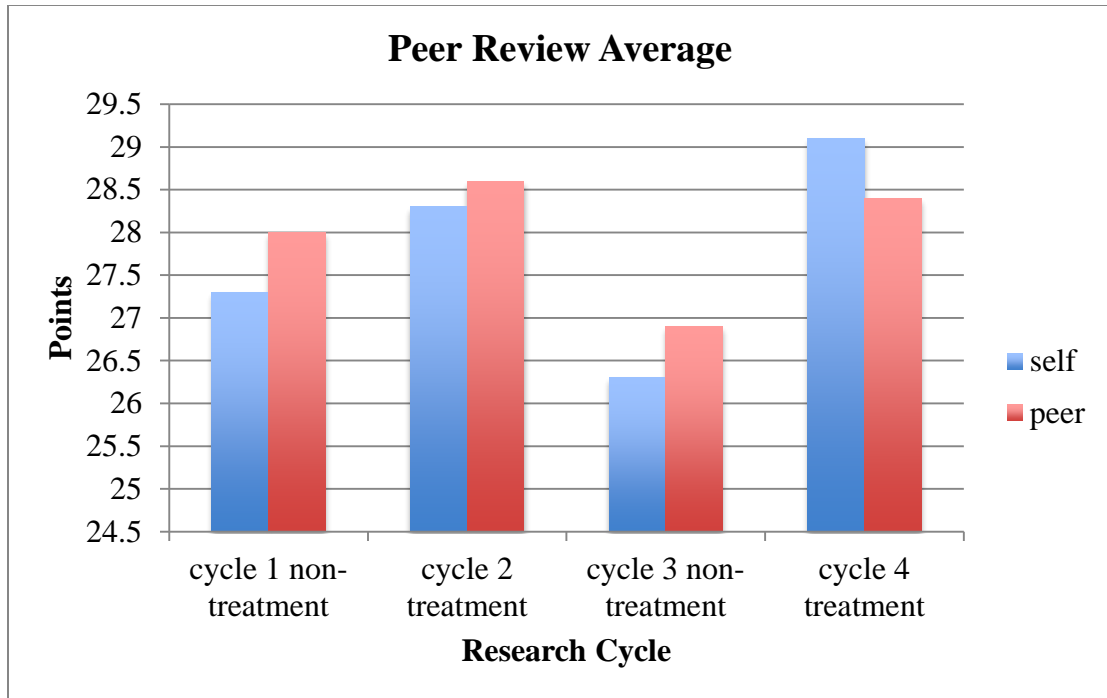
The results presented are a synthesis of quantitative and qualitative data taken during research cycles. Results showed increased engagement during treatment cycles. Absenteeism, a problem amongst students in high-needs areas (Jensen, 2009), affected sample size, thus creating a varied (N) number. At all times, efforts were made to gather as much data as possible for students who were present during science investigations.

To assess how differentiated groupings affected student self-perceived engagement, Likert-style peer reviews, observations, pre/post attitude surveys, and student interviews were used. The peer review utilized six statements based on a 5 point scale (30 total points), shown below in order.

- I worked cooperatively with my group
- I completed work related to my role in my group

- I stayed on task during the investigation
- I got along with my group mates
- I provided quality information to my group
- I enjoyed this investigation

Although the statements assessed different aspects of research: students' attitudes, achievement, and engagement, each student needed to be engaged in the investigation with their group to earn a positive score for each question. Each peer review asked an individual and a group member from his/her group to rate his/her engagement using a Likert-style scale. For example, if a student scored a "5" for the statement, "I got along with my group mates," and their peer also scored a "5" for that individual, then it can be concluded that the individual had a positive experience with their group during that science investigation. This aspect of the peer assessment bolstered validity and reduced bias. Figure 1 shows averaged individual and peer scores for all research cycles.



*Figure 1.* Peer Review Averages, (Cycle 1  $N=30$ , Cycle 2  $N=31$ , Cycle 3  $N=27$ , Cycle 4  $N=25$ ).

Figure 1 showed increased engagement during cycles when complex instruction was implemented using multiple intelligence groupings. During treatment cycles 2 and 4, students averaged: 28.3/28.6 and 29.1/28.4 self/peer. Contrarily, when random groups were implemented, students averaged 27.3/28.0 and 26.3/26.9 self/peer. In all cycles, five (4%) students had a greater than five point difference between individual and peer (total 113 peer reviews). The high levels of consistency between self and peer scores helped validate confidence in postulates derived from the data. Table 1 shows individual scores collected from peer reviews and their frequency for both non-treatment and treatment cycles.

Table 1  
*Individual scores on peer review (Non-treatment N=57, Treatment N=56)*

Non-treatment Cycles 1 & 3 (N=57) <i>Frequency / %</i>	Score	Treatment Cycles 3 & 4 (N=56) <i>Frequency / %</i>
12 / 21%	30	30 / 53%
6 / 11%	29	10 / 19%
8 / 14%	28	5 / 9%
10 / 17%	27	3 / 5%
5 / 9%	26	1 / 2%
3 / 5%	25	1 / 2%
5 / 9%	24	4 / 7%
3 / 5%	23	2 / 3%
4 / 7%	22	-
-	21	-
1 / 2%	20	-

When comparing the means between non-treatment and treatment cycles, scores were statistically significant. In a t test calculating all data retrieved from peer reviews, where  $t(57) = 4.00$ ,  $p = .0001$ . Of the peer reviews completed during treatment cycles, 48 (86%) students scored 27 or higher points for the individual ( $N=56$ ), compared to 36 (63%) students who scored similarly during the non-treatment cycle ( $N=57$ ). This data supports the use of complex instruction when groupings are differentiated using learner profiles in order to increase student engagement.

Data collected from pre and post attitude surveys revealed a shift in students' attitudes toward personal engagement during group work. In response to a pre-attitude

survey question, “When I am in a group, I normally stay on task,” approximately half of respondents, 54%, ‘agreed’ or ‘strongly agreed’, 32% were ‘undecided’, and 14% ‘disagreed’ or ‘strongly disagreed’ (pre-attitude survey  $N=28$ ). When given the same question on the post assessment, 82% ‘agreed’ or ‘strongly agreed’, 7% were ‘undecided’, and 10% ‘disagreed’ or ‘strongly disagreed’ (post-attitude survey  $N=29$ ). This was also supported by the teacher’s written observations. Journal entries provided descriptive trends of increased engagement during cycles 2 and 4, and notated more trials and off-task behavior during cycles 1 and 3. As the treatment cycles proceeded, it was apparent that students were able to focus better, complete tasks with more efficiency, and generally function at a higher level within their groups. During the final non-treatment cycle, some students had become visibly frustrated, eventually voicing their discontent and want to return to a “multiple intelligence group.”

Lastly, the use of midpoint and post interviews provided articulated responses that helped substantiate the findings found in the peer reviews. Mid-point student interviews showed that students actively enjoyed their role and their responsibilities. Of the six students interviewed, five had positive statements about their roles. Two students commented, “Cause I kinda feel good about getting things,” and “ I like setting up the experiment and getting ready.” In post interviews, five students agreed that their multiple intelligence strength helped them participate more, only one student stated that he would participate the same in either setting. When asked their preference between randomly chosen groups or groups where personal intelligence strength was paired to a role within their collaborative group, five out of six students preferred the latter. One student claimed, “I pick multiple intelligence groups because we get more work done when we

are in multiple intelligence groups and I get better grades... We were all working together, everyone was doing their part, and no one was arguing.” When prompted ‘why?’ the student accredited the work done by his group mates in respect to their intelligence-paired role. Another student of low-perceived status stated, “Because, it is actually what I want to be and I see what I’m suppose to do.” In some cases students had trouble articulating exactly how they felt and at times provided undeveloped explanations even after consistent promptings to deepen their response. What can be concluded is students felt more positive about their experiences during treatment cycles. Furthermore, their approval of working in multiple intelligence groups prompted a greater positive outlook on their self-efficacy.

#### INTERPRETATION AND CONCLUSION

The results of this study showed the use of equitable-groupings differentiated by learning style conclusively improved student engagement in a high-needs, high-diversity environment (Figure 1). Further, students reported greater approval of their own engagement and time spent in multiple intelligence groups. The treatments provided scaffolding for group work, giving more structure to groups, eliminating other variables that come with random groupings. Differentiated grouping using student’s multiple intelligence strength is prescriptive and showed to be effective in boosting student engagement, providing a tangible solution for this action research project. As most research does, this study brought to light more questions for the future: specifically the results of team-building and its effects on communication.

Throughout the research in both treatment and non-treatment cycles, the teacher continually emphasized communication and used team-building exercises to build trust and model healthy dialogue. In some instances, poor communication within a collaborative group would easily sidetrack the group, turning their attention toward personal topics rather than academic. These times often required teacher intervention to refocus the group. To help alleviate these problems, students participated in team-building exercises. Post interviews showed students enjoyed the activities; one student cited that the activities helped build bonds that they could rely on “in case we fight.” The use of team-building exercises complemented the treatments of complex instruction and flexible grouping, but the depth of its effects specific to engagement are uncertain.

The paths of this study led to many positive interactions between teacher and students. A unique part of this study was the validation students received from knowing their personal strength. The teacher had the opportunity to sit down with each student, sharing the results from their multiple intelligence inventories, validating each one as an intelligent learner who is crucial to their group’s success. This proved to be a powerful step, demonstrating the foundation of complex instruction. Given the observations and data showing increased engagement, a substantiated posit can be made- supporting treatments used in this study that helped students take a more active role in their learning due to self-validation within their group.

## VALUE

This action research showed the benefits of differentiating collaborative groups using learner profiles. Complex instruction (Cohen, 1999) provided treatments focused

on highlighting all learners and their unique intellectual strengths. This study also highlighted the use of multiple intelligence strengths (Gardner, 1983) and how they can be used for equitable-groupings. Team-building exercises provided complementary help, emphasizing the importance of communication. The aforementioned treatments worked synergistically under the over-arching umbrella of flexible grouping.

Finally, the study showed that students in a high-needs, high-diversity environment can successfully engage academically during science investigations. Challenges that catalyzed this action research were overcome using research-based treatments. Further, the importance of building strong relationships with students should never be undermined. The research was completed in a fifth grade setting, but should be viewed useful for teachers in similar situations.

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APPENDICES

APPENDIX A

PEER REVIEW

**INVESTIGATION:****NAME:****PEER REVIEWER:**

Rate how well you worked in group today. Use this scale:

A = GREAT! B= pretty good C= could use some work D= could use a lot of work  
F= TERRIBLE!

<u>Self Assessment</u>	<u>Objective</u>	<u>Peer Assessment</u>
A B C D F	I worked cooperatively with my group	A B C D F
A B C D F	I completed work related to my role in my group	A B C D F
A B C D F	I stayed on task during the investigation	A B C D F
A B C D F	I got along with my group mates	A B C D F
A B C D F	I provided quality information to my group	A B C D F
A B C D F	I enjoyed this investigation	A B C D F

*Please provide any further explanation below:*

Self Comments:

Peer Comments:

APPENDIX B

PRE/POST ATTITUDE SURVEY

**NAME:****DATE:**

Please complete the following survey using this scale: **Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D), Strongly Disagree (SD)**

**Respond to the following statements:**

1. *I enjoy working in a group. attitude*

SA    A    U    D    SD

Why did you answer the way you did?

2. *I feel that when I work in a group that I learn better.*

SA    A    U    D    SD

Why did you answer the way you did?

3. *I feel that I can be an important part of a group.*

SA    A    U    D    SD

Why did you answer the way you did?

4. *When I am working in a group, I normally stay on task.*

SA    A    U    D    SD

Why did you answer the way you did?

5. Rank the following learning settings on a scale of 1-4, with 1 being your least favorite setting to learn and 4 being your most favorite.

\_\_\_ Learning by yourself

\_\_\_ Learning from your teacher

\_\_\_ Learning in pairs

\_\_\_ Learning in small groups

Explain why you put the learning settings in the order you did. What makes one setting better than the other?

6. Below are some roles that are part of a group. Please read descriptions and jobs for each role. Then rank each role from favorite to least favorite. Put a **1** by your favorite role, **2** for the middle favorite, and a **3** for your least favorite.

Rank	Group Role	Job Descriptors
	Facilitator	<ul style="list-style-type: none"> <li>• Your job is to carry out the investigation</li> <li>• You also keep people on track</li> <li>• You may be asked to report your findings</li> </ul>
	Materials Getter	<ul style="list-style-type: none"> <li>• Your job is to gather materials for the investigation</li> <li>• You also clean and return each material</li> </ul>
	Recorder/Time Watcher	<ul style="list-style-type: none"> <li>• Your job is to record your groups results</li> <li>• You also keep time during the investigation and make certain your group finishes within the time allowed</li> </ul>

Please explain why you picked your favorite role:

Please explain why you picked your least favorite role:

What are some very good memories you have of working in a group setting?

What might be some not so good memories of working in a group setting?