

New Pieces of the Jigsaw Classroom: Increasing Accountability to Reduce Social Loafing in Student Group Projects

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Generally, college student group projects can be problematic due to students perceiving low accountability and withdrawing their efforts when working within a group. This paper presents an adapted jigsaw classroom method to improve learning for college students during group work. Although the original jigsaw classroom model is an effective approach for improving cohesion and collaboration, it lacks the structure that could improve college students' collaborative learning and promote accountability. This paper extends the original jigsaw classroom approach to increase personal accountability and facilitate group processes. This paper introduces a modified jigsaw classroom, in which each group member submits research notes to the instructor, thereby increasing individual accountability, and presents to the class, thereby increasing public accountability.

Keywords: small groups, teaching, jigsaw classroom

Although group projects in the classroom are a valuable opportunity for cooperative experiential learning (Weldy & Turnipseed, 2010), students are often pessimistic of group projects (Carpenter, 2006), perhaps because of previous negative experiences. A main theme in negative group work experiences is social loafing, in which group members do not feel accountable for contributing and reduce their efforts and contributions to the group (Latane, Williams, & Harkins, 1979). Another problematic process that occurs during group work is the sucker effect. This effect refers to non-social loafing students reducing their efforts in future group projects to avoid being the "sucker" who does all of the work (Kerr, 1983). Negative group processes such as social loafing and the sucker effect are likely to occur when students believe that their individual efforts are not related to their group's performance (Karau & Williams, 1993; Sheppard, 1993). When students give minimal effort in group projects, they fail to take advantage of learning opportunities for developing collaborative skills (Freeman & Greenacre, 2011). Moreover, those students who do not engage in social loafing may feel pressured to do most of the work and make up for their

peers' social loafing. When other group members are social loafing, the remaining group members may become skeptical of collaborative learning and engage in behaviors characteristic of the sucker effect (Kerr, 1983). This consequence corresponds to college students' concerns about group projects. Specifically, they are often concerned about fairness in the workload distribution and having to make up for social loafing (Walker, 2001).

Although the empirical research on the incidence of social loafing in college group work is relatively sparse, there is evidence that it occurs. For example, Aggarwal and O'Brien (2008) conducted a study with group projects in a college course where students in the groups rated the incidence of social loafing in their own group. On a scale ranging from 1 (some members didn't contribute at all) to 7 (everyone contributed equally), the mean was 3.32 (SD = 1.84), indicating that a substantial number of students perceived social loafing in their group. In a qualitative study by Colbeck, Campbell, and Bjorkland (2000), 32% of participants discussed having "slackers" in their work groups.

The problem of effort withdrawal within student work groups is unfortunate given that group work

has high potential for positive learning outcomes. Researchers have found a variety of benefits to group work at the college level. For example, group work allows learners to practice and develop the skills that are important for collaboration (Pfaff & Huddleston, 2003). In addition, group work offers more opportunities for critical thinking (Aggarwal & O'Brien, 2008) and, when groups function well, increased motivation to learn (Deeter-Schmelz, Kennedy, & Ramsey, 2002). Given these potential benefits, it is worthwhile to figure out a way to solve the problems of intentional effort withdrawal in order to maximize the benefits of group work.

The jigsaw classroom design has been used as a tool to encourage collaboration and equal distribution of effort in group work. The original jigsaw classroom divides the work by giving each student a particular component to investigate in their subgroups. Once students have gathered knowledge about their individual components of the project, they return to their home group to share their knowledge (Aronson, 2002; Aronson, Blaney, Stephan, Sikes, & Snapp, 1978). Compared to the original jigsaw classroom, the modified jigsaw design offers improved opportunities to enhance group dynamics and improve students' skills for employability (Landrum & Harrold, 2003). According to a survey of U.S. employers, the top five skills most desired in 4-year college graduates are oral communication, teamwork/collaboration, professionalism/work-ethic, written communication, and critical thinking/problem solving (Casner-Lotto & Barrington, 2006). The jigsaw classroom in its original form can help build relevant job skills by offering students the opportunity to practice their oral communication skills, teamwork skills, and critical thinking skills (Artut & Tarim, 2007; Perkins & Saris, 2001). The modified jigsaw classroom design allows students to practice skills from the original jigsaw as well as two additional skills. Students in the modified jigsaw classroom can practice their written and oral communication skills through the requirement to take notes and conduct a group presentation.

Aims of the Present Paper

In this review paper, a group project design that emphasizes individual accountability to prevent social loafing is proposed. The present paper introduces

a modified jigsaw classroom design to improve the structure of group projects. The traditional jigsaw classroom design is a method of organizing student group projects, with each student serving as an expert in a particular component for their home group. Students then work with subgroups in their expert area. Finally, like a jigsaw puzzle, students return to their home groups to bring their unique component to the project (Aronson, 2002; Aronson et al., 1978). The modified design presented in this paper is intended to encourage college students' accountability. Accountability refers to each group members' responsibility for the quality of their own work in the group project (Katzenbach & Smith, 1993). According to Katzenbach & Smith (1993), there are two types of accountability: individual accountability and mutual accountability. By using the modified jigsaw design, instructors can convey to students that they each have a responsibility to contribute equally and effectively to group projects.

The Original Jigsaw Classroom

The jigsaw classroom was originally designed to increase cooperation among classmates by requiring students to share resources and work interdependently (Aronson et al., 1978). Specifically, the jigsaw classroom was rooted in the desire to increase cooperative learning in elementary school classrooms following desegregation (Aronson, 2000). The jigsaw classroom provides students with the opportunity to contribute to a common goal, which encourages cooperative collaboration across social groups and discourages competitive, dismissive behaviors (Aronson, 2000). Like pieces in a jigsaw puzzle, group members first come together to learn about a broad topic in their home groups, then separate into subgroups to develop expertise on a specific topic, and then reassemble to collaborate with their home groups. Once the group members develop expert knowledge in their respective subtopics, they are responsible for teaching their home group about the subtopic and combining their efforts (Aronson, et al., 1978).

Throughout previous field research, the jigsaw classroom has been effective for increasing group members' involvement, competence, and autonomy (Hänze & Berger, 2007). It is considered an active,

engaging teaching method that can improve students' understanding, as well as their efficiency (Perkins & Saris, 2001). In a research study comparing different methods for teaching large college classes, Carpenter (2006) assessed and compared students' reactions and performances based on the teaching method. The methods compared were: lecture, lecture/discussion combination, jigsaw, case-study, and team project. According to the results of the study, students seemed to prefer the self-directedness of the jigsaw classroom compared to other teaching methods. In addition to students' positive reactions towards the jigsaw classroom, students made the greatest improvements from pretest to posttest when the jigsaw method was used. In sum, research has found that the outcomes of the jigsaw classroom include increased learning of the material and positive reactions from both instructors and students (Artut & Tarim, 2007; Carpenter, 2006).

Weaknesses of the Original Jigsaw Classroom

Despite these advantages, the original jigsaw classroom does have weaknesses, which will be addressed with the modified design. First, the jigsaw classroom was intended for the grade school setting (Aronson et al., 1978; Zacharia, Xenofontos, & Manoli, 2010). Although the extant research includes demonstrations of the jigsaw classroom for college students (Perkins & Saris, 2001; Artut & Tarim, 2007), there is currently no review of how to apply the jigsaw classroom to this setting, especially with a specific focus on accountability and preventing social loafing.

Artut and Tarim (2007) proposed the Jigsaw II design (Kagan, 1994) for training prospective elementary school teachers. Unlike the original jigsaw classroom, students in the Jigsaw II design take a pretest on the topic, read related material, teach it to their teammates, and then take a posttest to assess group improvement. The Jigsaw II further emphasizes cooperation because it incorporates a common group goal. Students using this method put more effort into learning the material than the control group, which suggests that the jigsaw group members took responsibility for their team's success. Given that the group setting can encourage social loafing (Latane et al., 1979), Artut and Tarim's (2007) Jigsaw II encourages the promotion of individual responsibility in groups. However, this design does

not provide structure during the individual learning process. Our modifications further emphasize individual responsibility by evaluating the individual note-taking that takes place before the group reconvenes.

Perkins and Saris (2001) used the jigsaw classroom to address students' learning needs in a college statistics course. Working cooperatively helped students learn from each other and share the workload of complex statistical computations. Students perceived the jigsaw classroom as beneficial and practical for the topic. Despite these advantages, the researchers did not address the social context of working in groups. Students are often reluctant to work collaboratively (Carpenter, 2006), and the interdependence of the original jigsaw classroom may not adequately change these attitudes. The modified jigsaw classroom promotes students' positive perceptions, similar to Perkins and Saris' (2001) study. By adding further structure to the original jigsaw classroom, instructors could convey that they are preventing social loafing and promoting a shared workload.

Second, the original jigsaw classroom was intended to promote cooperation and cohesion among students with diverse backgrounds (Aronson et al., 1978). This strategy encourages a classroom culture to be more collaborative and learning-oriented and less competitive. Although the jigsaw classroom emphasizes cooperation over competition, there is no existing modification that uses the cooperative component to address the lack of motivation and effort in social loafing (Aronson, 2000). Collaboration and cooperation are valuable to student group satisfaction (Chapman & Van Auken, 2001), but these aspects of group work do not include other teamwork skills that individual group members contribute for effective group work, such as planning and task completion (Stevens & Campion, 1994). The group's ability to work autonomously and direct themselves in the planning and execution of group tasks and overall goals is advantageous for group outcomes (Burdett & Hastie, 2009; Stevens & Campion, 1994). When students learn how to coordinate their efforts toward a group goal, they develop the type of collaborative skills that employers value (Landrum & Harrold, 2003). The original jigsaw classroom does not fully address these valuable processes and teach these collaborative

skills to college students (Hansen, 2006). Structured evaluation techniques (e.g., peer assessments) throughout the stages of the project, rather than only the final group outcome, are positively related to students' perceptions of planning and communication (Bailey, Barber, & Ferguson, 2015). The proposed modifications to the jigsaw classroom increase the structure and emphasize accountability. This modified design includes modifications to how the instructor evaluates group projects to emphasize accountability.

Proposed Design

Although the focus of the jigsaw technique is resource interdependence, this may not fully ensure group effectiveness (Cohen, 1994). The positive features of the original jigsaw classroom such as group members' involvement and cooperation can be modified to further emphasize these benefits. The proposed jigsaw technique could be augmented to have features that emphasize accountability, and thus promote a greater degree of group effectiveness and collaborative learning (Burdett & Hastie, 2009; Michaelsen, Fink, & Knight, 1997). This design improves on the original jigsaw classroom's emphasis on cooperation and makes the collaborative learning outcomes more relevant for college students' future careers. There are no variations on the jigsaw classroom that emphasize accountability to both students' own group members and other groups. By emphasizing accountability and interdependence in this modified design, instructors could more fully utilize the interpersonal benefits of the original jigsaw classroom. As a result, this modified design could help students learn effective collaborative processes for their professional development.

In light of these areas for improvement, the jigsaw classroom should be modified in two ways (see Table 1). First, the students will be required to take notes in their subgroups, which will then be used to assess each group member's contributions. Although students are expected to develop expertise in a specific topic during the subgroup component, the original jigsaw classroom does not explicitly require note taking (Aronson, 2000). Note taking is an opportunity for students to develop and convey their group contributions, specifically by helping students organize and recall the information when teaching

Table 1

Original Jigsaw with Modifications (Modifications are in italics)

- Students are members of their home groups as well as subgroups.
- *Students coordinate with their home group members to decide what information they will need to gather.*
- Students learn materials and meet with their subgroup, made up of members learning the same material.
- *In the subgroups, students take notes that will serve as a means of individual evaluation as well as a reminder when reporting to the home group.*
- Students report the material learned in the subgroup back to their home group.
- The home group works together to make a final project.
- *The home groups present their final projects to the class so that the group as a whole will be accountable, as each member must participate in the presentation.*

Note. Original Jigsaw Classroom information is from Aronson et al. (1978).

their groups. For example, research has found that students learn more from notes that they have created rather than study materials that have been generated by another person (Foos, Mora, & Tkacz, 1994). According to Valtonen, Havu-Nuutinen, Dillon, and Vesisenaho (2011), when students share their notes with other students, they have the opportunity to discuss their interpretation of the content and reduce uncertainty about the information. Second, at the end of the project, each group will present its final project to the rest of the classroom, with each group member having an active role in the presentation. These additions could prevent the negative consequences associated with social loafing (Karau & Williams, 1993; Sheppard, 1993) by creating an environment in which students are accountable for their contributions (Walker & Crogan, 1998).

In the modified jigsaw classroom, accountability is emphasized by having each group member produce an individual component (i.e., notes from their subgroup). The original jigsaw classroom has students collaborate together, but it does not include an evaluation of each individual's contribution (see Table 1). This individual evaluation component creates accountability in two ways. First, it creates accountability to other group members by setting the expectation for contributions to the project and effective processes. Effective group processes are positively related to favorable attitudes about group

Table 2
Example Uses of the Jigsaw Classroom

Subject	Group Member Tasks	Collaborative Group Outcome
Anatomy	Learn about major muscle groups	Present how the major muscle groups work together to perform a specific physical activity
Exercise Physiology	Learn about different aspects of health, fitness, and nutrition	Create a wellness program tailored to a hypothetical person's needs
English	Learn about different works of a classic author	Create a timeline of the author's work in relation to the genre and the author's career success
Foreign Languages	Learn how to conjugate and use different tenses of a verb	Act in a skit using various conjugated forms of the verb
History	Learn about major battles in a war	Create a map of how these battles ultimately influenced the outcome of the war
Physics	Apply the scientific method to a law of physics	Plan or conduct an experiment that would test one of the laws of physics

projects (Bailey et al., 2015). Second, it creates accountability to the instructor by providing an explicit contribution for instructors to review. Given that it is often a challenge for instructors to teach effective group processes (Hansen, 2006), evaluating students' note taking is an opportunity to evaluate their contributions to group processes.

Requiring students to take notes also sets the expectations that each group member will contribute and be personally accountable for his/her contributions. Furthermore, requiring note taking emphasizes both the interdependence and accountability involved in the project. Interdependence in group work is comprised of three components: task interdependence, goal interdependence, and outcome interdependence (Hertel, Konradt, & Orlikowski, 2004). Respectively these components refer to working on tasks that are structured to facilitate an interactive working environment, shared goals among team members, and rewards that are relevant to all team members (Wageman, 2001). According to Hertel et al. (2004), these components of interdependence are related to positive team outcomes such as satisfaction and team effectiveness. In addition, there are clear consequences for not taking notes. If group members do not write notes on their research, then it negatively affects their grade. The note taking also encourages self-directed learning, a valued aspect of the jigsaw technique (Carpenter, 2006).

The addition of a group presentation can further emphasize accountability. The group presentations can also offer the benefit of adding a social motivation to perform well. Students' efforts would not only be visible to their group members, but also to their classmates. The need to convey knowledge creates an incentive to thoroughly prepare and contribute to the project. If group members did not adequately contribute to the project, this will be apparent to their classmates during the presentation. In addition, the presentations are an opportunity for students to learn from each other by being assigned different but related topics.

Demonstration of the Modified Jigsaw Design

For demonstrative purposes, the jigsaw design will be described as it could be used in an undergraduate psychology class, though this design could be applied to many other contexts (see Table 2 for example topics). The topics described in Table 2 would be conducive to the modified jigsaw classroom because they are areas that can easily be divided into subtopics, while still being challenging for the students. To determine the groups, students would be assigned a letter and a number. The letter corresponds to their home group and the number corresponds to their subgroup. For example, if a student was assigned "C2" the home group would be "C" and the subgroup would be "2" (see Figure 1). Home groups are the

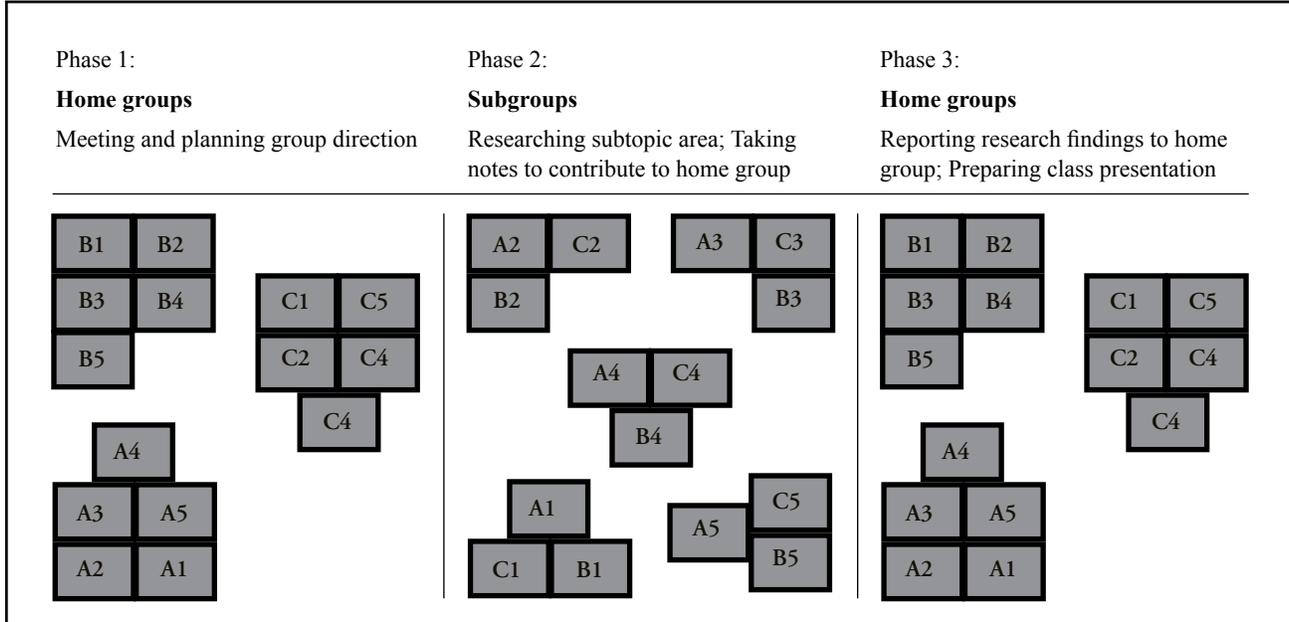


Figure 1. A demonstration of home groups and subgroups.

groups of students that work together to produce the final project. While in their subgroups, students learn about their specialty area so that they can bring that information back to their home groups.

Instruction

It may be difficult for students to understand the different phases of the jigsaw method. If students do not understand the jigsaw method, then they may revert to traditional group project methods (Zacharia et al., 2010). Therefore, it is suggested that students practice using this format with a brief task so that they can practice the three phases of the jigsaw techniques. This will help students see how the jigsaw classroom works. After becoming more accustomed to the design, students can apply the jigsaw techniques to the group project.

Learning Activity

To begin the project, students will split into their home groups to receive their assignment. For this example within a psychology class, the assignment will be to learn the different regions of the brain and deliver a presentation on how the brain functions during a particular behavior. The home group, as

a whole, would be assigned a particular behavior. Then, each student in the home group would be assigned a different major region of the brain (e.g., cerebellum, parietal lobe). Therefore, when members of the home group have combined their information about the different regions of the brain, the group can explain how the brain is relevant to the assigned behavior. See the Appendix for the assignment instructions. To gather information on their assigned brain region, students will go from their home group into subgroups to learn more about their brain region. In this example, all students studying the cerebellum would work together in a subgroup, and all students studying the parietal lobe would work together, and so on. In their subgroups, students would gather information and take notes that they would later share with their home groups and turn in to the instructor. Once the students have started working in their groups, it is important to monitor their progress to determine when they should return from their subgroup to their home group. This can be a long-term process that does not necessarily have to occur only in the classroom. Students can research outside of class and the instructor can monitor progress through updates from class members.

When the students have completed their research

and notes, they will return to their home groups to teach each other what they learned in their subgroups. The activity of taking notes, sharing subgroup information, and collaborating on a presentation is intended to instill accountability and interdependence among group members (Aronson, 2000). After learning from each other within subgroups, members of the home groups will combine their information about different brain regions to create a presentation. Each of the home groups will present its findings (i.e., the brain's activity during a particular behavior) to the class.

Enhancing Positive Features of Group Work

Currently, the jigsaw classroom is an excellent format for emphasizing collaboration and common learning goals (Aronson, 2000). However, these effective interpersonal processes do not address effective collaborative processes (e.g., accountability and planning; Chapman, Meuter, Toy, & Wright, 2010). These skills are significantly related to students having positive attitudes about group projects (Bailey et al., 2015). Emphasizing accountability with the jigsaw classroom can reduce social loafing and the sucker effect in various ways. Performance of the home group depends on each person's contributions, and group members are responsible for an equal portion of the group's knowledge (Larson, 2010; Steiner, 1972). The subgroup responsibilities instill accountability to others. The subgroup process creates clear expectations on each group member's responsibilities. These modifications to the jigsaw design encourage each group member to make contributions to both home and subgroups through their emphasis of accountability.

The modified jigsaw classroom also rewards hard-working, conscientious students who may feel taken advantage of during traditional group projects (Carpenter, 2006). This design assures hard-working group members that they will be a part of only one subgroup and will not have to compensate for others' lack of effort. The original jigsaw classroom was designed to equalize contributions across group members. However, the original jigsaw classroom does not include a method for checking individual group members' contributions. In the modified jigsaw design, notes from subgroups allow the instructor to evaluate individual group members' contributions.

Although each group member will be rewarded for contributing, there are also consequences for a lack of effort (i.e. lower individual grade). Each group member will be expected to give the same amount of effort, so that hard-working students will not be as likely to feel pressured to do other members' work.

The modified jigsaw classroom also benefits less conscientious students by providing a structure for effective group processes. Typically, students who are less conscientious are the social loafers in group projects (Hoon & Tan, 2008). Without the explicit expectations of note taking and a group presentation, these students may be inclined towards social loafing and a lack of contributions to group projects. This tendency to engage in social loafing can result in missed collaborative and content-related learning opportunities (Freeman, & Greenacre, 2011). Instructors can set expectations of conscientiousness and achievement for these students by using this modified jigsaw classroom design. Furthermore, the modified design's structure provides the opportunity for successful academic experiences that can set students up for positive experiences in the future.

Limitations

There are some limitations that should be considered in order to optimally use this teaching method. It is important to prevent group members from perceiving their individual contributions as dispensable, which could occur if the project is not challenging enough to require interdependent efforts. Although the original jigsaw classroom addresses the possibility that bright students may become bored during group projects, it does not address how this affects students' effort and contributions (Aronson, 2000). If the project does not consist of enough tasks for each group member to contribute, then students may be inclined towards social loafing and not contribute fairly to the note taking process. This imbalance is unfair to group members who do the majority of the work. Another important consideration when selecting the topic for the group project is the ability to easily divide a larger topic into sub-categories. This may be challenging for college-level classrooms because lessons often become increasingly complex and less easily divided among group members. This potential limitation can be addressed by carefully selecting a

topic that is appropriately divisible for this design, so that instructors can promote students' need to learn and teach one another and maximize the utility of the jigsaw classroom design (Zacharia et al., 2010).

Recommendations

To obtain maximum benefit for the modified jigsaw classroom, here are several recommendations for instructors. To ensure equal collaboration, instructors should only consider topic choices for the group project that offer a workload that can be equally divided among group members. Furthermore, instructors should emphasize that the project warrants collaboration, and that each group member's notes are a valuable contribution. A difficult project in which each group member provides necessary contributions will foster more interdependence and accountability than projects in which collective effort does not seem necessary or optimal (Cohen, 1994). Instructors should also try to put students into groups that are small enough to allow for perceptions of accountability. In his summary of how to implement the jigsaw classroom process, Aronson (2000) recommends that the home groups consist of five students each. If groups are not of equal number, then some students may have to take on roles in multiple subgroups. This could disrupt the balance of each group member's contributions and interfere with perceptions of fairness within groups.

In conclusion, this modified design builds on the advantages of the jigsaw classroom, with additional emphasis on accountability. By instilling accountability, students may be more motivated to contribute to their groups and learn collaborative skills. The modified jigsaw classroom is designed to encourage students to take responsibility for their learning and prevent social loafing. By incorporating accountability, instructors could reduce social loafing and students may have improved perceptions of group projects.

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- number. The letter corresponds to your home group and the number corresponds to your subgroup. So if you were student "B3" for example, that would indicate that you were in home group B and subgroup 3.
- Your home group's assignment is to put together a 10 minute presentation about the brain's functioning during an activity (e.g., eating, sleeping, exercising, talking, etc.). The subgroups are:

- 1: Frontal lobe
- 2: Temporal lobe
- 3: Parietal lobe
- 4: Occipital lobe
- 5: Cerebellum

Your home group is responsible for planning and delivering a presentation of your findings. Your "findings" will come from each person's subgroup. In your subgroups, each of you will gather information and take notes to bring back to your group about the component that you are responsible for. **Your individual performance will be evaluated on the notes you take, so be sure to make strong contributions.** Be sure to be attentive in your subgroup, it definitely relates back to helping your home group!

After your subgroups are done with their research, you will get back together with your home group. Now is the time for you and your group members to share the knowledge and expertise gained from your subgroups. Put together your notes for a slideshow presentation that includes all five parts of the brain. This presentation will need to be about 10 minutes long and will need to include contributions from each of your group members. **This slideshow is what your group will be evaluated on, which will be a part of your grade.**

Appendix A: Guidelines of Group Project

Group Project

Working in groups can really help us gather the information we need to see the big picture of an issue. Like pieces in a puzzle, each individual contributes an essential piece of information to the group.

Each group member will be given a letter and group