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Social and Academic Advantages and Disadvantages of Within-class Heterogeneous and Homogeneous Ability Grouping

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Social and Academic Advantages and Disadvantages of Within-class Heterogeneous and Homogeneous Ability Grouping

Abstract

This study reviews research and examines studies on the effects of within-class ability grouping on middle school student's academic achievement and motivation to learn. Four seventh grade science classes were placed into 16 randomized and then heterogeneous and homogenous ability groups and tested after each. The main findings indicate that high ability students may succeed in either ability grouping style. Average ability students showed better group performance in homogenous ability groups but tested better as a result of heterogeneous grouping. Low ability students experienced much greater academic achievement as a result of heterogeneous ability groups. Finally, topics for future areas of research are discussed.

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Social and Academic Advantages and Disadvantages of Within-class Heterogeneous and
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By

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Abstract

This study reviews research and examines studies on the effects of within-class ability grouping on middle school student's academic achievement and motivation to learn. Four seventh grade science classes were placed into 16 randomized and then heterogeneous and homogenous ability groups and tested after each. The main findings indicate that high ability students may succeed in either ability grouping style. Average ability students showed better group performance in homogenous ability groups but tested better as a result of heterogeneous grouping. Low ability students experienced much greater academic achievement as a result of heterogeneous ability groups. Finally, topics for future areas of research are discussed.

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Social and Academic Advantages and Disadvantages of Within-class Heterogeneous and Homogeneous Ability Grouping

A group is two or more people with common interest, objectives, and continuing interaction (Nelson, 2008). Within-class grouping provides academic and social benefits for students. Individual academic productivity is limited by time, knowledge, physical capabilities, and other resources. Group work greatly reduces these limitations through teamwork and collaboration.

Within-class grouping has social benefits important for student development as well. A student's individual social benefits are realized by achieving psychological intimacy and achieving integrated involvement (Nelson, 2008). Psychological intimacy is a psychological closeness to other group members. It is important to a student's overall emotional health because it results in positive feelings of affection and warmth. Achieving psychological intimacy will also reduce feelings of emotional isolation and loneliness. Integrated involvement is closeness achieved through the involvement of students in group tasks and activities. It is beneficial to students because it provides them with opportunities to define themselves, support their beliefs and values, and be appreciated for their skills and abilities while greatly reducing instances of social isolation. Achieving integrated involvement fulfills a student's social needs as psychological intimacy does a student's emotional needs.

There is little debate that within-class grouping is important to enhance student achievement and development. Some controversy does exist when deciding what method of group formation should be used. In the past, instructors have used less scientific method such as numbering, or alphabetically by last name. Students have been given the

option to choose their own groups or simply grouped by seat proximity. While these methods can be effective in some situations depending on the curriculum or sheer luck, grouping students by their ability level is a more controlled and deliberate approach to grouping and can result in much greater achievement and development. This study will investigate the effect of ability grouping on student achievement and student attitude and behavior towards academic achievement.

Literature Review

Within-class ability grouping is the practice of separating students within a classroom by ability for class activities (Tieso, 2005). Ability is determined by the student's demonstrated performance, levels of prior knowledge, and the teacher's initial assessment of the student's level of readiness (Slavin, 1990; Tieso, 2005). Within-class ability grouping is most common in elementary and middle schools (Lou, Abrami, Spence, Poulsen, Chambers, & Sylvia, 1996; Slavin, 1990; Tieso, 2005). The two categories of within-class ability groups are homogeneous and heterogeneous. Heterogeneous ability groups are composed of students with a broader range of abilities. Students of high, average, and low-ability are grouped together for the purpose of working towards a common goal. Conversely, a homogenous ability group is composed of students with the same or similar abilities. Both methods of grouping can be associated with positive and negative effects on a student's academic achievement and social development. They do not, however, affect each student in the same way. Studies have divided students into three categories, low-ability, average-ability, and high-ability, and have identified and examined the positive and negative effects of heterogeneous and homogeneous ability grouping on each.

Heterogeneous Within-Class Ability Grouping

Heterogeneous within-class grouping presents social and academic advantages and disadvantages for teachers and students. Hooper (2003) found advantages to include an increase in self-esteem and an improvement in the students' attitude toward school work and their peers. Towns, Kreke, and Fields (2000) identified benefits past the

improvement of attitude towards peers, and included an important sense of community within the classroom. Advantages of mixed grouping specific to low-ability students include having the opportunity to socialize and learn from students with average or high-abilities and a decreased chance of feeling stigmatized which may help increase their motivation to learn (Saleh & De Jong, 2005; Poole, 2008). Advantages specific to high-ability students include: experiencing academic benefits from verbally reinforcing material they understand, avoiding unwanted social stigmas that may be associated with high-ability students, and developing valuable leadership skills (Ballantine & Larres, 2007; Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996; Saleh & De Jong, 2005; Poole, 2008; Slavin, 1987; Tieso, 2005). Possible disadvantages to heterogeneous ability grouping have been recognized. The same stigmas that may be associated with high and low-ability students, as a result of homogenous grouping, may only be reinforced by heterogeneous grouping. This may cause dysfunction in a group and severely hinder academic achievement. It has also been found that average-ability students do not typically show achievement gains as significant as those with high or low-abilities if any (Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996; Saleh & De Jong, 2005; Poole, 2008).

Advantages of Heterogeneous Ability Grouping

Heterogeneous ability groups benefit students by improving their attitudes toward each other and school work, building a sense of community within the classroom, and providing valuable social and academic lessons (Ballantine & Larres, 2007; Hooper, 2003; Obaya, 1999; Robinson, 2008; Towns, Kreke, & Fields, 2000). Towns, Kreke, and Fields (2000) found that mixed-ability groups enhanced achievement by requiring

students to participate and become more active in their learning. In addition to improved academic achievement, this research includes benefits such as an increased positive attitude toward the subject area studied, higher self-esteem, greater acceptance of peer's differences, greater retention of material, and "enhanced conceptual development across content areas and in a wide range of educational settings" (Towns, Kreke, & Fields, 2000, p.111). The student's developed a sense of community which was beneficial as they grew closer and learned that each had different strengths and weaknesses. When questions arose in the group, the students learned who would be best suited to answer it.

Placing low-ability students in heterogeneous ability groups provides them with opportunities to make significant academic gains. These gains can be realized for several reasons, including: improved understanding of the curriculum, improved study habits and learning techniques, increased confidence, and an increased motivation to learn. There are several ways that low-ability students are able to learn from the high ability students in their group (Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996; Saleh & De Jong, 2005; Obaya, 1999). High-ability student's often have, or develop, the capacity to teach material for which they have a strong understanding, to lower-ability students who are struggling. Even the simple clarification of challenging topics, from another student, proves to be beneficial to low-ability students (Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996).

Poole (2008) showed that low-ability students can develop and improve skills from simply observing and interacting with high-ability students. These observations and interactions provide identifiable models of a successful student. Poole's research

indicates that having an example of effective study habits and learning techniques could be what the low-ability student needs to reach the next level of academic achievement.

Poole (2008) also found that low-ability students will frequently feel more comfortable asking their peers for help with challenging material, than they would asking their instructor. The clarification of complicated topics provided by high-ability students has the potential to build confidence in low-ability students (Heath, 1999; Saleh & De Jong, 2005). The increased confidence in low-ability students, stemming from understanding material through a peer's perspective, provides them with more opportunities for analytical thought. Well-developed questions pertaining to the curriculum provide the need for these explanations and clarifications, and may not be as likely in homogeneous ability groups.

Highly functioning groups require an optimum level of conflict in order to inspire thought and give new perspective (Nelson, 2008). Diversity in groups, including groups with diverse abilities, increases the chances of reaching this level of conflict. Homogenous ability grouping reduces diversity and the chances conflict. Groups with extremely low levels of conflict may become susceptible to groupthink. Groupthink occurs when all of the students' thoughts have become similar and unchallenged by the other group members. This can be counterproductive to group-work and possibly avoided by introducing diversity into groups. Nelson (2008) identifies the clear curvilinear relationship between conflict/diversity and production in a group (See Figure 1). Too much conflict, like too little, will result in a dysfunctional and unproductive group. It is also important that the conflict is based in the steps leading up to the goal and not the goal itself. While conflict can enlighten and create new perspective, goal conflict is a

major threat to a group's productivity. Group goals should be clear, measurable, and agreed upon by all group members.

Heterogeneous ability groups provide the potential for greater academic achievement in high-ability students. Research shows that high-ability students are called upon more in a heterogeneous ability groups to provide leadership, and explanations of the material through peer elaboration, or individual knowledge constructed from group interaction (Ballantine & Larres, 2007; Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996; Saleh & De Jong, 2005). Ballantine and Larres's (2007) study of mixed ability groups showed that low-ability students benefited the most overall except in the area of leadership. Students that participated in the study found the experience to be "beneficial in terms of developing skills which will equip them for the workplace and lifelong learning" (Ballantine & Larres, 2007, p.132). Saleh and De Jong's (2005) research said:

Giving explanations encourages a student to clarify and reorganize the material to make it understandable to others. Such elaborative talk helps both parties to understand the material better...The explainer benefits from the cognitive restructuring involved in peer tutoring in that it might trigger the detection and repair of misconceptions and knowledge gaps. (p.106)

These studies all conclude that high-ability students that assume the role of the teacher will experience increased understanding and personal achievement.

Mixed-ability group interaction resulting in an increased clarification of material and new learning techniques for low-ability while restructuring and solidifying curriculum in the high-ability students, could ultimately reduce the demands placed on

instructors (Tieso, 2005). Without the need to create multiple versions of the same material for several different levels of readiness, the instructor would have more opportunities to respond to well-developed questions that can not be resolved in group discussion. This type of peer tutoring prevents high-ability students from becoming bored while keeping low-ability students up-to-speed, making for a exemplary student centered classroom.

Neihart (2007) found that students perceived mixed-ability groups to offer the greatest number of social and emotional benefits. This can be attributed to the decreased likelihood of the stigmatization of high and low-ability students (Poole, 2008). Some students are uncomfortable being labeled by other students or teachers as either or low or high-ability. Groups formed by homogenous abilities are more likely to reinforce these stigmas. Being labeled, or perceiving to be labeled, as having low-abilities can severely hinder a student's academic achievement. It is the tendency of low-ability students to perform their expected role regardless of their potential for achievement. Likewise, students labeled, or perceived to be labeled, as high-ability may also experience decreased performance. In some cases students labeled low-ability have greater success socially; high-ability students may underperform in an attempt to fill their social needs. Heterogeneous grouping has the potential to avoid or reduce the creation of these stigmas. It is less likely that students in heterogeneous ability groups will identify and compare the abilities of other students outside their groups and label them accordingly.

The increase in participation and confidence, as well as the decrease in stigmatization that may be realized through heterogeneous ability grouping, could result in a classroom of students motivated to learn and achieve (Lou, Abrami, Spence, Poulsen,

Chambers, & d'Apollonia, 1996; Saleh & De Jong, 2005). Motivation's role in student achievement as a result of heterogeneous ability grouping is another aspect of this topic researched and studied by Saleh and De Jong (2005). These studies concluded that low and high-ability students are more motivated to learn in heterogeneous groups. This motivation in low-ability students stems from the belief that the presence of higher-ability peers gives them greater opportunities to improve their own performance (Heath, 1999; Saleh & De Jong, 2005). Increased motivation in high-ability students in mixed-ability groups was just as likely but for different reasons (Saleh & De Jong 2005; Obaya, 1999). The majority of high-ability students gain motivation from helping others and consider it just as valuable as discussing material with peers of equal-ability.

Disadvantages to Heterogeneous Ability Grouping

Research outlining the benefits of heterogeneous ability grouping, as it pertains to high and low-ability students, also identifies and describes several disadvantages of this grouping style. One inherent disadvantage affecting all mixed ability groups is the increased potential for intragroup stigmatization (Poole, 2008) While mixed-ability grouping reduces the possibility of the larger student body labeling a group of students, within a group, stigmas may still exist. A disadvantage of mixed-ability grouping specific to low-ability students is the decreased opportunity to participate in groups dominated by high-ability students (Poole, 2008). Mixed-ability grouping also presents disadvantages specific to high-ability students. One example is the student's perception that their progress is being slowed by the low-ability students (Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996; Saleh & De Jong, 2005; Poole, 2008). The group most frequently affected negatively by mixed-ability grouping is the average-ability students.

Average-ability students have been found to benefit least from heterogeneous ability grouping. With respect to the level of increased achievement experienced by both high and low-ability students, heterogeneous ability grouping seems to not have any positive impact on the achievement level of average-ability students. (Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996; Saleh & De Jong, 2005; Poole, 2008).

Some studies have shown that heterogeneous ability groups can have a negative impact on a student's achievement, participation, motivation and self-esteem when applied to particular disciplines such as reading. Poole (2008) conducted a study of fifth grade students placed in two mixed-ability groups in which students took turns doing read alouds and discussing the text. This study found that low-ability students suffered from lowered academic achievement as a result of being in a mixed-ability reading group. The three low-ability students that were studied during the group meetings were found to have read less than the other students. The teacher's tendency was to give them smaller passages to read than their group members. These three students being studied were also interrupted by the teacher much more than their peers. Interrupting the low-ability students was the teacher's reaction to struggling readers as opposed to having them sound the words out. Poole (2008) concluded that these three students did not reach the academic achievement they would have if they had been placed in groups with students of the same reading level and had been given an equal opportunity to read and learn from the read aloud. This type of interaction within a mixed-ability group will have negative effects on self esteem, leading to a loss of motivation for learning. Poole (2008) acknowledges these results may not be relevant to all disciplines, but this type of interaction is something to watch for in heterogeneous ability groups. Davies (2003) found that

homogenous within-class ability grouping was the arrangement most prevalent in subjects such as Mathematics and English, while mixed-ability grouping was more common in all other subjects. Low-ability students in heterogeneous reading groups resulted in their receiving less allocated reading time and experiencing a higher frequency of interruptions compared to average and high-ability readers. These behaviors can hinder the progress and decrease the self-esteem of low-ability students. Occurrence of mixed ability grouping such as this also increases the likelihood that low-ability students will be stigmatized.

The negative impacts that heterogeneous ability grouping can have on high-ability students is not as specific to discipline. Studies have shown that high-ability students progress slower and do not reach their full potential as a result of interacting with lower-ability students (Rogers, 1998). High-ability students can experience a further decrease in motivation to learn if they develop the belief that working with lower-ability peers will hinder their progress (Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996; Saleh & De Jong, 2005; Poole, 2008).

Studies have shown that average-ability students do not experience any significant achievement gains from working in a heterogeneous ability group. Some researchers have even found that average-ability students actually suffer from lowered achievement as a result of mixed-ability grouping because they tend not to participate (Saleh & De Jong, 2005). Average-ability students are frequently excluded from the teacher-learner relationships that exist between low and high-ability students (Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996; Saleh & De Jong, 2005). Research also indicates that average-ability students are not reaping the benefits

associated with working in groups because they are missing out on the dialogue that promotes student achievement (Saleh & De Jong, 2005). The study by Saleh & De Jong (2005) said that in:

Heterogeneous groups, low-ability students asked eight times as many questions as average ability students. High-ability students asked no questions at all, but provided about 75% of the explanations. Average-ability students contributed to a mere 15% of the explanations, which barely exceeds the amount of explanations given by low ability students 10% (p. 117).

This research indicates average ability students lack the opportunity for engagement while in mixed-ability groups. This is a result of the high-ability students providing explanations at an extremely high rate depriving, in most cases, the average-ability students opportunity for critical thought.

Homogeneous Within-Class Ability Grouping

Homogeneous within-class ability grouping is more specific in targeting which groups it will benefit and which it will hinder. Increases group cohesiveness is the major advantage that homogeneous grouping provides to all ability-levels (Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996; Robinson, 2008). The advantages of homogeneous ability grouping are almost exclusive to average and high-ability students. Average-ability students, while gaining almost no academic benefit from mixed-ability grouping, thrive in homogeneous ability groups. High-ability students also experience benefits in homogeneous groups such as deeper processing of material and acquiring advanced knowledge (Rogers, 1998). The burden of this grouping style is placed almost entirely on the low-ability students and teachers. Studies have shown that high-ability

students can experience some disadvantages as well. Low-ability students that are placed in homogeneous ability groups achieve little to no understanding of the material and may develop low self-esteem (Heath, 1999; Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996; Poole, 2008; Slavin, 1987). Teachers are negatively affected by homogeneous ability grouping because of the increase demand it places on them to prepare and differentiate several plans for one lesson to cater to all levels of readiness (Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996). High-ability students in homogeneous ability groups are less likely to develop communication skills, leadership skills, and a deep understanding of material (Ballantine & Larres, 2007; Hallam & Ireson, 2007). A general disadvantage to all students is that once a student is placed in a homogenous ability group, it is difficult to move to either higher or lower groups (Hallam & Ireson, 2007).

Advantages of Homogenous Ability Grouping

Levy (2008) found that the content more than the curriculum was an important reason to group students by like abilities. Every student is responsible for the same curriculum but the content can vary depending on ability level. Failure to make these adjustments in content will confine students with high-ability and not provide essential knowledge or building blocks for low-ability students to move on to the next task. Homogeneous ability groups are helpful in filling in the details of the lesson. Once the teacher has taught a general concept to the entire class, forming smaller groups by ability or learning style will provide specific support to students. Levy (2008) also suggests that ability groups are not difficult to change and can be adjusted each time the students are evaluated.

Homogenous ability grouping is more conducive to achieving group cohesiveness in students of all ability levels. Group cohesion is an important element in increasing academic achievement within a group because students share the same standards, goals and expectations (Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996; Robinson, 2008). Nelson (2008) describes the importance of group cohesion by saying:

Groups with low levels of cohesion have greater difficulty exercising control over their members and enforcing their standards of behavior...tension and anxiety were lower in highly cohesive teams. Conversely, these traits were higher in teams low in cohesion. (p. 139)

Nelson's (2008) research identifies the relationship between group cohesion and an individual's tension and anxiety. The increased comfort level students feel as a result of group cohesion has a positive effect on academic achievement (Saleh & De Jong, 2005; Poole, 2008). Nelson's (2008) research also found that group productivity was more predictable in cohesive groups. Highly productive groups would continue performing near the same high rate of production just as groups with low productivity would continue to be unproductive as a result of both group's high cohesiveness. This research also showed that a group's "member satisfaction, commitment, and communication are better in highly cohesive groups" (p. 139). Benefits of group cohesion also include a reduction in social loafing or, "The failure of a group member to contribute personal time, effort, thoughts, or other resources to the group" (p. 136). Nelson's (2008) research also identifies the curvilinear relationship between group cohesion and group functionality. A group with too high levels of cohesion will function just as poorly as a group with low levels of cohesion. Nelson's (2008) example of how extremely high

cohesion can detract from group functionality is the social process of group members losing their individuality. Loss of individuality is a process in which “individual group members lose self-awareness and its accompanying sense of accountability, inhibition, and responsibility for individual behavior” (p. 136). Cohesion will often result in all group members have the same commitment and goal (Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996). While this benefits students in all ability levels, it is particularly beneficial to average and high-ability students because they tend to set higher goals than low-ability students. Group cohesion, as a result of homogenous ability grouping, also provides average and high-ability students opportunities to work at a faster pace than they would if they were in mixed-ability groups.

According to a study done by Lou, Abrami, Spence, Poulen, Chambers, and d'Apollonia (1996), learning in homogenous ability groups is greatly increases the chances of average ability students to achieve higher academic standards. Saleh and De Jong (2005) explain:

in homogenous groups, average-ability students play a more active role in learning discourse and learn more when compared with average-ability students in heterogeneous groups...they ask more questions and receive more explanations than when they are a part of a heterogeneous group (p. 107).

Average-ability students are able to achieve more as a result of being in a homogenous ability group where they can ask questions and give explanations on an equal level (Saleh & De Jong, 2005)(Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996) (Rogers, 1998) (Slavin, 1987). Average-ability students have a greater participation rate,

ask more questions, receive more explanations, and reap a greater amount of benefits associated with group work when placed in a homogenous ability group (Saleh & De Jong, 2005).

According to Rogers (1998) high-ability students also tend to benefit from being in homogeneous ability groups. In a homogenous ability group, high-ability students are provided with the “opportunity to access more advanced knowledge and skills and to practice deeper processing” (p. 44). Research has shown that high-ability students benefit from both homogeneous and heterogeneous ability grouping in different ways (Heath, 1999; Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996; Saleh & De Jong, 2005; Rogers, 1998; Tieso, 2005). Homogenous ability groups may not solidify concepts in high-ability students as well as working in mixed-ability groups, but does allow them to work at a faster pace and set higher goals. The deeper processing and advanced knowledge homogeneous ability grouping provides to high-ability students is extremely valuable in learning and increasing academic achievement.

Disadvantages of Homogenous Ability Grouping

Low and high-ability students and teachers suffer some disadvantages as a result of homogenous ability grouping. As previously discussed, high-ability students will not get as many opportunities to restructure and elaborate on material as they would in mixed-ability groups (Saleh & De Jong, 2005). High-ability students can also be at a disadvantage because of the pressure and high pace of a homogenous ability group environment (Hallam & Ireson, 2007). Pressure and the fast pace contributed to high-ability students not getting a deep understanding of content. These lost opportunities

decrease the level of performance and the chance for the high-ability student to develop leadership skills and internalize and solidify the material. Another disadvantage is that once a student is placed in a homogenous ability group it can be difficult to move up or down regardless of increased or decreased performance. Hallam and Ireson (2005) found that students were aware of homogenous group allocation even at primary levels. These primary level students perception of group movement was that it was possible, but difficult. The main contributing factor to the difficulty of group movement was not that students weren't increasing performance, but for every student that did qualify to advance, a student had to move down.

The group most specifically disadvantaged by homogenous ability grouping is low-ability students. According to Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia (1996) and Slavin (1987) homogeneous ability grouping is damaging to low ability students. Low-ability students work at a slower pace and can detect a teacher's decreased expectations of performance and quality of instruction. This is harmful to a low-ability student's academic achievement, motivation to learn, and self-esteem.

Low-ability students have much lower academic achievement when placed in homogenous ability groups for the same reasons their achievement increases when placed in mixed ability groups (Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996; Saleh & De Jong, 2005). In homogeneous ability groups, these students miss out on dialogue with higher-ability peers that have a better understanding of the material and are able to elaborate and explain it more effectively to them than other low-ability students could. Low-ability students will not be capable or confident enough to ask well-developed questions when placed in homogenous ability groups.

They are also exposed to very few positive behavior models in a group of all low-ability students, unlike being in a group with high-ability students who are often good models of positive behavior both academically and socially (Slavin, 1987). Heath (1999) and Slavin (1987) agree that these low-ability students are prone to absentism, drop out, social problems, and are less likely to go to college. Low-ability students suffer from missing out on the opportunities to observe, identify and simulate examples of a successful student (Poole, 2008). Being surrounded by other low-ability students limits the chances of developing good study habits and learning techniques. Without these necessary tools, low-ability students have a decreased chance of higher achievement and experience very little motivation to learn.

Negative stigmas develop as a result of homogenous ability grouping. Hallman and Ireson (2005) found that teachers assessed students by their perception of them rather than their academic performance or potential. While the teacher made proper judgments in group allocation most of the time, cases in which they were wrong had negative effects. Some students were placed in low-ability groups because of the teacher's perception of them. This perception was based on prior performance, performance of siblings, background characteristics, and even physical appearance rather than academic performance or potential. These low-ability students suffered heightened inequalities in academic achievement over the course of several years. Pigford (1990) found that the methods teachers used in forming ability groups also included punishment as a consideration. This was found to be ineffective in providing students with an optimum learning environment.

The motivation to learn is an important aspect of reaching academic achievement and is lost in low-ability students in homogenous ability groups. These students tend to develop a negative attitude towards school (Heath, 1999). The negative attitude comes from a feeling of being segregated or isolated and feeling inadequate to their peers in other groups (Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996). These negative feelings of isolation, and inadequacy will result in lowered levels of self-esteem. Having a high level of self-esteem also plays an important role in maintaining the optimum amount of motivation to learn. Nelson (2008) defines and describes self-esteem as:

...an individual's general feeling of self-worth. Individuals with high self-esteem have positive feelings about themselves, perceive themselves to have strengths and weaknesses, and believe their strengths are more important than their weaknesses. Individuals with low self-esteem view themselves negatively. They are more strongly affected by what other people think of them, and they compliment individuals who give them positive feedback while cutting down people who give them negative feedback (p. 39)

Nelson's (2008) research on self-esteem suggests that low-ability students in homogenous groups will begin to feel that their weaknesses (ability) is more important than their strengths (what they feel they have to offer to their peers). This will lead to negative feelings about themselves and a decreased motivation to learn. Nelson (2008) goes on to describe the benefits of self-esteem by saying, "A person's self-esteem affects attitudes and behavior...A work team made up of individuals with high self-esteem is more likely to succeed than a team with low or average self-esteem" (Nelson, 2008).

Low-ability students in homogenous ability groups will also experience a loss in motivation to learn as a result of low self-efficacy. Nelson's (2008) research identifies self-efficacy as a person's general belief in their capabilities. This research also recognizes "Previous success or performance" as "one of the most important determinants of self-efficacy" (p. 39). Heath (1999) has shown low-ability students experience low success rates as well as low rates of performance. Nelson's (2008) research indicates the result of low-ability students in homogenous groups would be lowered self-efficacy. Nelson (2008) describes the importance of high self-efficacy by saying:

People who trust their own efficacy tend to attempt difficult tasks, to persist in overcoming obstacles and to experience less anxiety when faced with adversity. Because they are confident in their capability to provide meaningful input, they value the opportunity to participate in decision making (p. 38).

Valuable opportunities to raise levels of self-efficacy and esteem in low ability students are not common in homogenous ability grouping.

Low-ability students are at a disadvantage in homogenous ability groups as a result of their teacher-student relationship as well. According to Nelson (2008), variations of the two dimensions of leader behavior are needed for different levels of readiness which is determined by ability and willingness. Based on the Ohio State Leadership Studies, a leader's behavior has two dimensions: task orientation and relationship orientation. The Hershey-Blanchard Situational Leadership Model (See Figure 2) illustrates how these two dimensions of leader behavior should change depending on the

follower's readiness. Homogenous ability grouping would require the leader or teacher, to treat each group of students with varying levels of ability and willingness, with relative levels of task or relationship oriented behavior. The Situational Leadership Model recognizes four major categories of follower readiness. Followers are: able and willing, able and unwilling, unable and willing, or unable and unwilling (See Figure 3). Low-ability students will fit into the unable and, either willing or unwilling categories. If the low-ability student is unable and unwilling, the Situational Leadership Model suggests the most effective leader behavior would be highly task oriented with little effort on relationships. The teacher with a low-ability group fitting this description would "provide specific instruction and closely supervise performance" (Nelson, 2008, p. 192).

Assuming the low-ability group is unable and willing, the model suggests the teacher's most effective leadership behavior is to be highly task oriented and highly relationship oriented. This behavior would require the teacher to "explain decisions and provide opportunity for clarification" (p. 192). This category of readiness is extremely demanding and requires the most attention of the four. The behavior needed to effectively lead each different level of readiness within a classroom places unrealistic expectations on the teacher. This suggests that homogenous ability grouping within a classroom detracts from student centered learning because of the high involvement of the teacher in a leadership role. The low-ability students who require the largest amount of the teacher's resources will be the group who suffers most from homogenous grouping because, as Pigford (1990) found, teachers spend less time teaching low-ability groups than high-ability groups.

Closely related to the high demands placed on teachers behavior in classrooms with homogenous ability groups, are the high demands and increased difficulty of lesson preparation. The amount of the materials a teacher needs to provide is greatly increased as a result of trying to cater to each ability level in a homogenous ability grouped classroom (Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996). The average ability group requires the least amount of adaptation and can be both challenged and able to get through the regular teaching material; high ability students can get through regular teaching material but many times need something more to elaborate on in order to challenge their thinking; low ability students need something much more basic and skill driven than regular teaching material. The teacher is faced with the challenge of taking regular teaching material and having to both cut it down to the basics and to elaborate and extend it (Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996).

Homogenous ability groups have a greatly reduced rate of peer elaboration causing the teacher to have to make more rounds to each group ensuring they all understand the material (Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996). The increased demand of differentiating behavior and materials required to cater to a homogenous ability grouped classroom, can result in the teacher getting burned out and losing motivation. An unmotivated teacher will cause a decrease in the student's motivation to learn which is essential for academic achievement. (Gadbois & Thomas, 2007)

Summary

The improvement of academic achievement in most students can be realized by creating the right mix of material resources and motivation to learn. Social and emotional development, improved self-esteem, and a safe and comfortable learning environment are a few of the contributing factors in achieving proper levels of resources and motivation (Gadbois & Thomas, 2007; Saleh & De Jong, 2005; Nelson, 2008). Within-class ability grouping offers many characteristics that can both add and detract from these and other contributing factors.

The two methods of within-class ability grouping, heterogeneous and homogeneous, each offer separate and unique advantages. Both offer different levels of academic gains for each ability level. Academically, low-ability students benefit the most from mixed-ability grouping (Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996; Saleh & De Jong, 2005; Poole, 2008). High-ability students benefit from a deeper understanding of material as a result of mixed-ability grouping but are confined by the pace of their low-ability peers (Lou, Abrami, Spence, Poulsen, Chambers, & d'Apollonia, 1996). Least affected by mixed ability grouping is average ability students who seem to make no significant academic gains as a result of this grouping style (Saleh & De Jong, 2005). Homogenous ability grouping offers a much greater amount of academic advantages to average ability students as they seem to thrive when surrounded by peers of equal ability. High-ability students also can reach higher academic achievement as a result of being challenged more in a homogenous ability group providing the pace and pressure is manageable (Rogers, 1998). Heterogeneous ability groups are identified as being valuable in developing social and emotional skills such as leadership, self-esteem,

and self-efficacy (Nelson, 2008). The improvement of these skills is essential in motivating the students to learn and increase academic achievement (Gadbois & Thomas, 2007; Slavin, 1987).

Both methods of ability grouping can be associated with disadvantages that can hinder academic achievement as well as social and emotional development. Mixed-ability grouping has the potential to greatly hinder the performance of average and high-ability students. Likewise, homogenous ability grouping can lead, and contribute to the repeat failure, frustration, and negative attitude of low-ability students. Homogenous ability grouping can also cause the development of stigmas within the classroom. These stigmas can have lasting effects regardless of whether students show improvement in performance or ability. High-ability students miss out on valuable lessons in leadership, while functioning in a homogenous group, and may experience poor academic performance as a result less understanding and pressures from the fast pace of the group. Students of all ability levels are put at a disadvantage when a teacher's allocation of students in homogenous ability groups is skewed by somewhat meaningless data rather than accurate measures of performance and potential or loose motivation due to high demands placed to differentiate behavior and content to cater to all of the group's ability levels.

Methodology

This study is designed to identify the advantages and disadvantages of ability grouping and determine the effects it has on student achievement. The teacher followed a specific procedure as she was teaching a unit on the circulatory systems. The procedure mimics that of prior unit studies with slight modifications allowed to gather research on the effects of ability grouping. Four, seventh grade, classrooms participated in the study and were evenly divided into heterogeneous and homogenous ability groups. All of the participating groups received the same instruments and materials throughout the course of the unit. The data collected during the study was carefully organized to monitor academic achievement and perceived behavioral patterns that can be directly linked to future academic achievement.

Participants

The participants in this study consisted of seventh grade students from four science classrooms in a public middle school located in a small suburban area in upstate New York. The students' ages range from 11-12 years. This school serves a population of predominately Caucasian students (approximately 97%), and three percent or less of American Indian, Asian, Hispanic, and black. Approximately 23% of all students qualify for free or reduced meals.

For the purposes of this study, each of the four classrooms was referred to as groups A through D. Every student in each of the four groups was labeled as high, average or low ability. The ability level of the students was determined by unit exam scores from September 2008 through January 2008 as well as objective teacher

observation. Students with average unit exam scores ranging between 85 to 100 percent were labeled as high ability. Students whose exam scores range between 70 to 84 percent were labeled as average ability. Students whose exam scores were below 69 percent were labeled as low ability.

Group A consisted of 16 students, eight of the students were females and eight were males. Group B consisted of 16 students, six of the students were females and ten were males. There was one male in group B with a 504 plan. Group C consisted of 17 students, nine of the students were females and eight were males. There was one male in group C with a 504 plan. Group D consisted of 16 students, seven students were female and nine were males. Of the 17 students, eight had IEP's. These groups were determined according to the teacher's class schedule. The students in group A and group B were further grouped into groups of four according to ability. Students of similar abilities were grouped together (homogeneous ability grouping). Group A consisting of 16 students was broken into four groups. Group A1 consisted of four high ability students. Group A2 consisted of four average ability students. Group A3 consisted of four average ability students. Group A4 consisted of four low ability students. Group B consisting of 16 students was broken into four groups. Group B1 consisted of four high ability groups. Group B2 consisted of four average ability students. Group B3 consisted of average ability students. Group B4 consisted of four low ability students.

The students in group C and group D were further grouped together into groups of four or five according to ability. Students of mixed ability were grouped together (heterogeneous ability grouping). Group C1 consisted of two low ability students, two average ability students, and one high ability student. Group C2 consisted of one low

ability student, two average ability students, and one high ability students. Group C3 consisted of one low ability student, two average ability students, and one high ability student. Group C4 consisted of one low ability student, two average ability students, and one high ability student. Group D1 consisted of two low ability students, one average ability student, and two high ability students. Group D2 consisted of one low ability student, two average ability students, and one high ability student. Group D3 consisted of two low ability students, one average ability student, and one high ability student. Group D4 consisted of two low ability students, one average ability student, and one high ability student.

Instruments and Materials

All instruments and materials in this study have a primary purpose to help teach or assess the understanding of the curriculum. Power point notes, a heart diagram, circulatory system activity centers, a lab comparing heart rate and activity level, a study guide, and a unit exam were all used to teach the curriculum. A heart diagram (appendix B), circulatory system center questions (appendix D), and questions based on the heart rate lab (appendix C) also measured academic achievement as well as provided insight to individual attitudes and behaviors which could lead to academic achievement. Individual attitudes and behaviors observed and noted by the teacher include patterns of leadership, student participation, and motivation to learn (appendix G).

Power point notes include all information and topics on the circulatory system. Power point notes were provided to give the students general and specific information on the topic which they were required to know for the end of unit exam. The heart diagram was to be labeled by the students including blood flow through the heart, blood type

through the heart, and all structures. The diagram was used to help students organize the information given to them in the power point notes. During completion of the diagram the teacher was able to observe individual attitudes and behaviors of students working in their ability groups. Four differentiated activities pertaining to the circulatory system were placed at centers to increase understanding of the curriculum. Questions followed each of the activities. Group performance was assessed according to the answers provided as well as teacher observation. The heart rate lab was used to reinforce concepts discussed in the power point notes about the heart. During data collection (appendix G), the teacher was able to observe attitudes and behaviors of students within different ability groups. The questions based on the data provided an assessment of individual/ group understanding of the topics in this unit. The study guide (appendix E) provided a complete overview of the circulatory unit. It contained six questions on general concepts and specific functions of the circulatory system. During the completion of the review sheet the teacher was able to assess through observation attitudes and behaviors as well as the amount of learning that had occurred throughout the unit. The unit exam (appendix F) consists of fourteen questions with multiple parts to each question based on similar concepts covered in the review sheet. The unit exam was used to assess individual student's academic achievement. Each student's performance on the unit exam has been compared to prior unit exam scores to determine the effect of ability grouping on academic achievement.

Data Collection

The data collection for this research included: teacher observation and academic achievement. The data sources for teacher observation were heart diagram, circulatory

activity centers and questions, heart rate lab data collection and questions, and study guide. The data that was measured from these sources included instances of leadership, development of self-esteem, self-efficacy, and the quality of discussion in groups. The teacher used a spreadsheet to monitor perceived instances of each during observation and interaction with the groups. The spreadsheet listed in rows the prior data to be measured with an extra row labeled other to include other relevant data not listed above. The rubric's column headings were labeled by group number, A1-D4. As the teacher made notes about each group, extra care was taken in clearly marking which student demonstrated identifiable behavior patterns. Within each data box the group's consistency was labeled using the abbreviations for each ability level.

Data sources for academic achievement were past unit exams, circulatory system center activity questions, heart rate lab questions, and the circulatory system unit exam. The grades the students received were tracked in the teacher's grade book as percent correct for each assignment. The circulatory system unit exam was compared to the past unit exam on the digestive system to measure improvement or lack thereof. Grades from other assignments were monitored for progression or regression of academic achievement. Tables were used to compare the student's grade to prior performance as well as to the grades of other students in similar and different styles of ability grouping methods. Tables 2A and 2B contain data for the students in homogeneous and ability groups. Tables 2C and 2D contain data for the students in heterogeneous ability groups. Tables 3A through 3C compare tables 2A through 2D. The data contained in tables 3A through 3C shows patterns of academic achievement in relation to both grouping styles.

Procedure

The course material during this study focused on students learning about the circulatory system. This was one unit out of a seven unit course and was taught between the dates of January 14, 2009 and January 28, 2009. The teacher's format for teaching a unit begins with providing the students with organized notes, followed by conceptual group work and hands on group work. Each unit is concluded with a day of review and a unit exam.

Day one started with circulatory system notes using power point on the respiratory system. Students followed along individually as the teacher discussed the notes with the class as a whole group. After the notes students were then placed into their predetermined ability groups and completed a diagram of the heart students were expected to label the heart and color the oxygen rich parts of the heart red and oxygen poor parts of the heart blue. This was based on material presented in the power point notes. Each student filled out their own diagram and kept it in their science binders. The teacher observed and took notes on patterns of leadership, student participation, and motivation.

The following class period the students regrouped for conceptual activities. Four circulatory activity centers were set up around the room containing a short activity on the circulatory system and questions pertaining to the activity. Each group spent seven minutes at each center and rotated around the room clockwise until each group completed all centers. The questions were handed in at the end of class for the teacher to grade. The teacher also assessed behaviors through observation.

The third class period students regrouped for a hands-on lab activity. The students took turns measuring their heart rate after each of three separate physical activities. After each group completed collecting data they examined and discussed the data and answered questions pertaining to it. The questions and data were handed in for the teacher to grade. The teacher also assessed behaviors through observation.

The fourth class period students regrouped for a review of the material presented throughout the circulatory system unit. Each group completed a study guide packet together. Students then took these packets home and used them to review for the circulatory unit exam.

In the final class period for the circulatory system unit students completed a unit exam based on the material they studied with their ability groups. The teacher used this exam as a summative assessment and compared the individual scores students achieved on the exam to prior unit exam scores. The teacher then compared academic achievement of the low, average and high ability students in the homogenous ability groups to academic achievement of the low, average and high ability students in the heterogeneous ability groups.

Results

The data from this study were collected using teacher observation on in-class group work and records of student achievement comparing multiple ability group scenarios. The participants consisted of four classrooms of seventh grade middle school science students ranging in age between 11 and 12 years. The participants were objectively categorized by ability and included high, high/average, average, low/average, and low ability students. The data represented the results of placing classrooms A and B into homogenous-ability groups and classrooms C and D into heterogeneous ability groups. This study was designed to identify advantages and disadvantages of ability grouping as well as to determine potential effects on student achievement. This was done through qualitative and quantitative means.

The qualitative data collected consisted of teacher observations during group work. The teacher objectively identified changes in student behaviors and attitudes associated with academic achievement. Such behaviors and attitudes included: self-esteem, self-efficacy, quality of group discussion, and leadership. The teacher also made note of other behaviors she felt were contributing to academic achievement but not applicable to the previous categories. The quantitative data measured academic achievement by comparing performances on two unit exams. The first unit exam, on the human digestive system, was taken prior to forming any ability-based groups. The digestive system unit was taught over the course of two weeks and used the same format of organized note provisions, conceptual groupwork, hands-on groupwork, review, and examination. Random student selection for groupwork was performed by the teacher for the digestive system unit. The second unit exam, on the human circulatory system, was

taken after forming ability-based groups, and two weeks of unit study using the same format for presenting the curriculum. The data collected from these two exams were compared side by side, noting per-student changes.

Qualitative Tables

The qualitative data collected through teacher observation were recorded in tables represented in Appendix G, which were labeled by class and type of ability grouping. Each of the tables had four columns identifying the group being observed. Each column was divided into four rows identifying recognizable behaviors or attitudes said to affect academic achievement: self-esteem, self-efficacy, quality discussions, and leadership. A fifth row was added to record additional observations that would not fit into the previously mentioned categories. Within the spaces created by the intersecting the columns and rows observations were recorded using an H, A, and L to identify whether the behavior or attitude was demonstrated by a High, Average, or Low ability student respectively.

The data collected through teacher observation strongly suggested greater academic advantages to heterogeneous grouping. The recorded observations in table 4C affirms these advantages with the recognition of high ability students demonstration of confidence or increased self-esteem, and leadership capacity. In heterogeneous group C1 the high-ability student was noticed taking an instant leadership role (refer to tables 1A through 1D for group constitution). This student spoke to the teacher when the group needed clarification of activity instructions and answered the questions of lower ability students when curriculum questions arose in the group. The teacher felt through observation that this high ability student had taken some responsibility for the learning of their peers. According to the teacher's observation, most of the average ability students in

heterogeneous groups C1-D4 continued to work at their own pace. Two average ability students were observed exhibiting signs of increased self-esteem due to their contribution to group discussion as observed by the teacher. The teacher also recorded observations in the attitudes and behaviors in low ability students. Most low ability students in heterogeneous groups exhibited more interest in the material discussed but did not contribute much to discussions. Those who did make positive contributions did so in the form of on-topic questions to higher ability students. Low-ability student in groups D2 and D4 were not as engaged as low-ability students in other groups. The teacher also observed these low ability students causing within group distractions as others tried to stay on task. They resisted higher ability students attempt to lead the group and stay focused on the activity. Group D2 consisted of three low-ability students, one high-ability student and one average-ability student. Group D4 consisted of two low ability students, one high-ability student, and one average-ability student. The teacher observed that some groups in which low-ability students outnumbered higher-ability students, had a more difficult time staying on task despite the efforts of higher-ability students. High and average-ability students in extreme cases would choose to work independently of the group. Low-ability students who achieved higher academic achievement as a result of heterogeneous grouping not only took a greater interest in the curriculum but also looked up to higher ability group members, taking social cues regarding appropriate interaction, conversation, and study techniques. In some cases, low ability students would mimic the note taking and answer look-up techniques of their higher ability group members.

Further demonstration that heterogeneous ability groups were at an advantage to increase academic achievement was observed in the behavior and attitudes of students

placed in homogenous ability-groups. In the high-ability homogenous groups, students were able to accomplish tasks but demonstrated less interest, more distraction, and a greater tendency to work independently or with little discussion. Similar to the heterogeneous groups, the high ability homogenous groups asked the teacher for activity clarification but also made some inquiries related to the curriculum. Group A1 worked almost entirely independently while participating in off-topic discussion. The only observed instance in leadership among the high ability homogenous groups was in group B1. The student exhibiting the leadership skills had behaved similarly in all group situations and the teacher did not attribute the behavior to grouping style.

Low-ability students exhibited extremely low amounts of self-efficacy in homogenous-ability groups. These students did not even attempt questions that they were not absolutely sure of. In most cases, low-ability groups conducted off-topic discussions. There were signs of leadership, but the students were not leaning toward academic achievement. In one group a low ability student attempted to keep other group members on task but quickly gave up and chose to work independently while the other group members carried on with off-topic conversation. At the time the assignment was due, the distracted students asked for the answers from the one member who quietly completed the assignment. The teacher commented that lack of self-esteem played a big role in the students' tendencies to stray off-topic. These students were not confident discussing school work so would make every attempt to change or stray from the topic. None of the low-ability groups ever approached the teacher for help or indicated they had any questions about the assignment. Those who completed assignments were a result of independent work with very limited or no science related group discussion.

According to the qualitative data gathered through teacher observation, the students that seemed to benefit the most from homogenous ability grouping were the average ability students. Group discussion stayed on-topic more than in low and high ability groups but still easily drifted away from scientific topics. The teacher observed the average ability students working well together and using each student's strength's to compensate for weaker areas. Overall, the average ability students were also much more inclined to ask the teacher for help. In some cases, students approached the teacher with a question before consulting other group members. Average-ability students that exhibited leadership roles did so in all group activities. Other students in the group responded well to the leadership and stayed on task better than groups without a student assuming a leadership role.

Quantitative Tables

The quantitative data collected, represented by tables 2A through 2D, 3 and 4, also suggested that heterogeneous grouping could lead to academic achievement. This data was not as strong as the previously discussed qualitative data yet some conclusions were made. Tables 2A-2D list, by individual student, performances on the circulatory system exam and the digestive system exam. The digestive exam was taken prior to ability grouping and the circulatory system exam was taken post ability grouping. This data was used to create Tables 3 and 4, which showed the analysis by ability group of grade increases and decreases. Most students in heterogeneous ability groups experienced increases in academic achievement. Of the high ability students in heterogeneous ability groups, 55% had increases in exam scores post ability grouping while 45% experienced decreases. This trend was also true for the average ability group of which 50%

experienced increases in scores while 43% decreased and 7% experienced no change.

The group that received the most benefit for heterogeneous ability grouping was the low ability students of which 60% experienced increased exam scores, 30% a decrease, and 10% no change. Perhaps more impressive evidence in table 3 is the amount of increase experienced by low ability students. On average, low ability students in heterogeneous ability groups increased their exam score by 12.5%.

Students participating in homogenous ability groups experienced different results overall. While the high ability students still experienced increases on average, the average and low ability students experienced overall decreases. Of the high ability students in homogenous ability groups, 50% experienced an increase in exam scores while 37.5% a decrease and 12.5% remained the same. Compared to the heterogeneous groups, less high ability students experienced increases and decreases and more remained at the same score. The high ability students who experienced increases did so by an average of 5.5%. The average increase of high ability students in heterogeneous ability groups was 3%. Further, the high ability students who experienced decreases did so by an average of 14% compared to an average decrease of only 3.8% in heterogeneous groups. This showed that while less students experienced a decrease as a result of homogenous ability grouping, those who did, did so by a much greater margin. Average and low ability students exhibited more substantial evidence of the possible negative effects homogenous ability grouping had on academic achievement. Of the average ability students who worked together, 25% experienced increased exam scores while 58% decreased and 17% experienced no change. Likewise, low ability students working together experienced only a 30% overall increase, while 50% of the student's exam

scored decreased and 20% remained the same. While, the amount of students who participated in heterogeneous ability groups who experienced increases seemed inconclusive at first glance, compared to the results of the students in the homogeneous ability groups, it looks much more substantial.

Discussion

It has been proposed that ability grouping can have distinct effects on academic achievement and a student's behavior and attitude toward learning. Based on the results of this research grouping students by ability does impact students of all ability levels in separate and meaningful ways in regards to academic achievement, behavior and attitude. A greater amount of students increased exam scores as a result of heterogeneous grouping suggesting this is the more effective form of ability grouping. More convincingly than the exam scores however, were the teachers observation of the students behavior and attitudes while in ability groups. Overall, the students participating heterogeneous grouping stayed on task better, exhibited more signs of effective leadership, had greater quality of discussion, and showed more signs of increased self-esteem and self-efficacy than students in homogenous ability grouping. These observation also indicate heterogeneous grouping is the superior form of ability grouping when striving for academic achievement. The results showed that it was not just a greater increase in exam scores experienced by students in heterogeneous groups but most students exam scores suffered as a result of homogenous ability grouping.

It was clearly presented in the literature review that students behavior and attitude toward school can have a significant impact on immediate and long-term academic achievement. While it was unclear whether the avoidance of social stigmas was a factor in the success of students in heterogeneous ability groups, Saleh and De Jong (2005) and Poole's (2008) supported these results in several other ways. Low-ability students were

observed learning curriculum and useful study techniques from higher-ability students as suggested in the literature. Low-ability students in heterogeneous groups asked quality questions to higher ability group members and were even observed adopting new study techniques while attempting to mimic higher ability group members. Ballantine and Larres (2007), Lou, Abrami, Spence, Poulsen, Chambers, and d'Appolonia (1996), Saleh & De Jong (2005), Poole (2008), Slavin (1987), and Tieso (2005) all identified verbal reinforcement and the opportunity to develop valuable leadership skills as advantages of heterogeneous grouping that were supported by this research. Instances of high-ability students assuming and performing leadership roles in heterogeneous ability groups was clearly observed by the teacher in this research. Although group direction was sometimes challenged by lower ability students, those students assuming leadership roles were successful in keeping the group focused and engaged. High-ability students observed in this research also demonstrated leadership when approaching the teacher for clarification of activities and, in some cases, took a personal interest in the learning of lower ability group members. As the literature also indicates, the overall increase in high ability students exam scores demonstrated the importance of verbally reinforcing material. The research shows a discernable difference in the quality of group discussion between heterogeneous and homogenous ability groups. While high-ability students in homogenous groups were prone to completing assignments with little or no on-topic discussion, those in heterogeneous groups were forced to put their knowledge into words by the questions of the lower-ability members of their group.

The results of this study also supported disadvantages of heterogeneous ability groups identified in researched literature. Lou, Abrami, Spence, Poulsen, Chambers, and

d'Appolonia (1996), Saleh and De Jong (2005), and Poole's (2008) research also found that average-ability students do not typically show achievement gains as significant, if any, as high and low-ability students in heterogeneous groups. This research supports these literary works demonstrated by the results of two exams. 50% of average-ability students in this study did show an overall increase compared to 55% of high-ability students and 60% of low-ability students. This study also recorded the teacher's observation of group discussion noting a much lower amount of participation by average-ability students. This observation was also noted by Saleh and De Jong's (2005) research depicting the rates of contribution by students in heterogeneous ability groups. Saleh and De Jong's research also indicated lack the opportunity for engagement in heterogeneous groups as a result of high-ability students providing explanations at a extremely high rate. The teacher observation noting average-ability students continuing to work at their own pace instead of the established group pace also exhibits a lack of opportunity for average ability students to engage in critical thought. Disadvantages of heterogeneous grouping identified in researched literature specific to high and low ability students such as high ability student's academic achievement being hindered and low-ability students suffering from decreased self-esteem were not supported by this study.

The results of this study regarding homogenous ability groups tended to contradict and support the ideas represented in the researched literature equally. Lou, Abrams, Spence, Poulsen, Chambers, and d'Apollinia (1996) and Robinson's (2008) studies identified advantages of homogenous ability grouping to be specific to high and average ability students. They attribute this to many factors with the main factor being increased group cohesion. While the results of this study did show more high-ability

students increased their exam scores than decreased, average-ability students experienced only 25% of students increased in scores while 58% decreased. The relationship of group cohesion to these results was also difficult to support according to the teacher's observation. Both high and average ability students did exhibit high levels of group cohesion which supports Lou, Abrams, Spence, Poulsen, Chambers, and d'Apollinia (1996) and Robinson's (2008) studies, however this cohesion did not help promote academic achievement in average ability students as indicated by the significant amount of average ability students whose scores decreased as a result of homogenous ability grouping. Likewise, while 50% of high ability students experienced increased scores compared to the 37.5% who experienced decreases, the high levels of group cohesion seemed to hinder higher academic achievement. This observation was supported by the curvilinear relationship between group cohesion and performance identified by Nelson (2008). Nelson's (2008) research determined that extremely high levels of group cohesion, like extremely low levels, could detract from group functionality and performance. It was observed by the teacher that high ability students in homogenous groups tended to conduct discussions relating to off-topic issues instead of the task given in the in-class activity. The teacher observed that these students often belonged to the same social groups and felt extremely comfortable with each other. This increased comfort level was determined to be the reason for decreased individual accountability and increased distraction.

The performance predicted by low-ability students in homogenous groups by the researched literature was strongly supported by the results of this study. Lou, Abrami, Spence, Poulsen, Chambers, and d'Appolonia (1996), Saleh and De Jong's (2005) studies

showed low-ability students performing very poorly due to factors including low self-esteem, lack of motivation to learn, and missed dialogue with higher-ability students who had a better understanding of the material. The results of the teacher observations also cited instances of low self-esteem and low self-efficacy among low-ability students in homogenous groups. This was demonstrated when the students would only answer the two questions they were absolutely sure about without attempting others they did not feel confident about. This lack of self-efficacy or belief in their personal capabilities greatly hindered these students in accomplishing group assignments. This observation supported Nelson (2008) and Heath's (1999) who identified self-esteem and self-efficacy as important factors contributing to performance and motivation. The Ohio State leadership studies citing the importance of high teacher involvement in the success of the unable and unwilling to be successful was also supported by the results of this study. The high rate of low-ability students who experienced decreased exam scores could be attributed to the lack of teacher involvement. The low-ability students in homogenous groups in this study never took advantage of opportunities to ask the teacher questions. The lack of confidence within this group led to discussions entirely off topic and extreme amounts of distraction making group functionality almost non-existent.

Despite many of the ideas researched were supported by this study, the results may have been more credible and able to provide better insight with some adjustments to the methodology. First and most importantly, the size and scope of the study should have been larger in order to draw clearer conclusions from the results. This study used participants from four seventh grade classrooms within one middle school. If more classrooms outside of this school participated in the study, the results would have been

much more credible. A second adjustment to the methodology would be to conduct the study using the same curriculum. Although the format in which the material was presented was exactly the same, some students could have found either the circulatory system easier or harder to understand than the digestive system. These changes have the potential to provide different outcomes than this study provided and should be considered for potential change.

Conclusion

The qualitative and quantitative data provided in this study as well as in the researched literary works has given a great deal of insight into the potential effects of ability grouping on student's academic achievement and behavior and attitudes toward learning. These are equally important functions of learning. While immediate achievement is highly measurable, increased confidence, opportunities to lead, and motivation to learn can all have long term effects on achievements throughout a student's academic career and beyond. Further research with a broader participant base is needed to answer lingering questions about ability grouping that were not clearly answered by this study and past research. Perhaps the most important questions include; do the benefits high-ability students receive from activities in heterogeneous groups outweigh the opportunities to learn at a faster pace with deeper discussion that they may experience in a homogeneous ability group? If not, how should we determine whether the benefits of homogeneous ability grouping experienced by high-ability students outweighs the sacrifices that causes low-ability students deprived of a great deal of opportunity for critical thought? Finding the answers to these questions may bring ideas of fairness and equality not addressed in this study or literature identified in this study. If homogeneous grouping is clearly more beneficial to high ability students is it unfair to them to put them in heterogeneous groups? Likewise, are homogeneous ability groups formed for the benefit of high-ability students fair to low-ability students who may not get the same chance at achievement? These are important questions and may help to further understand what type of grouping would improve academic achievement for all students.

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Appendix A:

Tables & Figures

Table 1

Table 1A: Homogeneous Ability Group A

Group	Group Member Abilities
A1	H, H, H, H
A2	A, A, A, A
A3	A, A, A, L
A4	A, L, L, L

Note: H = High ability, A = Average Ability, L= Low ability

Table 1B: Homogeneous Ability Group B

Group	Group Member Abilities
B1	H, H, H, H
B2	H, A, A, A
B3	A, A, A, A
B4	L, L, L, L

Table 1C: Heterogeneous Ability Group C

Group	Group Member Abilities
C1	H, A, A, L
C2	H, A, A, L
C3	H, L, A, L
C4	H, A, A, L

Table 1D: Heterogeneous Ability Group D

Group	Group Member Abilities
D1	H, H, A, L,
D2	H, A, L, L
D3	H, A, A, L

D4

H, A, L, L

Table 2

Table 2A: Unit Exam Results: Circulatory System versus Digestive System Class A

Digestive Exam	Circulatory Exam	% Change	Ability Level
73	86	+13	H
75	53	-22	L
83	78	-5	A
91	86	-5	A
87	76	-11	H
80	76	-4	A
55	55	0	L
82	67	-15	A
76	76	0	A
73	82	+9	A
93	94	+1	H
67	82	+15	L
84	84	0	A
77	65	-12	L
96	96	0	A
70	67	-3	A

Note: H = High A = Average L = Low

Table 2B: Unit Exam Results: Circulatory System versus Digestive System Class B

Digestive Exam	Circulatory Exam	% Change	Ability Level
82	55	-27	A
95	69	-26	H
88	86	-2	A
74	65	-9	L
95	90	-5	H
87	88	+1	H
73	63	-10	A
76	88	+12	L
71	71	0	L
63	92	+29	A
63	67	+3	L
74	80	+6	A
96	94	-2	L
89	96	+3	H
74	67	-7	A

Note: H = High A = Average L = Low

Table 2C: Unit Exam Results: Circulatory System versus Digestive System Class C

Digestive Exam	Circulatory Exam	% Change	Ability Level
98	98	0	L
89	94	+5	H
76	62	-14	A
91	96	+5	L
94	84	-10	H
72	74	+2	L
59	57	-2	L
85	94	+9	A
91	94	+3	A
89	90	+1	H
86	88	+2	A
75	67	-8	A
98	88	-10	A
89	94	+5	A
91	82	-9	A
90	94	+4	H
80	71	-9	A

Note: H = High A = Average L = Low

Table 2D: Unit Exam Results: Circulatory System versus Digestive System Class D

Digestive Exam	Circulatory Exam	% Change	Ability Level
78	76	-2	H
77	84	+7	A
84	94	+10	A
55	60	+5	L
100	96	-4	H
44	67	+23	L
53	55	+2	L
90	90	0	A
65	48	-17	L
39	33	-6	L
77	90	+17	A
76	65	-11	A
100	98	-2	H
97	96	+1	H
50	88	+38	L
96	98	+2	H

Note: H = High A = Average L = Low

Table 3

Table 3: Heterogeneous

	High Ability	Average Ability	Low Ability
% of Students whose grade Increased	55%	50%	60%
% of students whose grade decreased	45%	43%	30%
% of students grade remained the same	0%	7%	10%
Average % of students whose grade increased	3%	6%	12.5%
Average % of students whose grade decreased	3.8%	10.4%	8.3%

Table 4

Table 4: Homogeneous

	High Ability	Average Ability	Low Ability
% of Students whose grade Increased	55%	50%	60%
% of students whose grade decreased	45%	43%	30%
% of students grade remained the same	0%	7%	10%
Average % of students whose grade increase	3%	6%	12.5%
Average % of students whose grade decrease	3.8%	10.4%	8.33%

Figure 1

Group Behavior versus Diversity

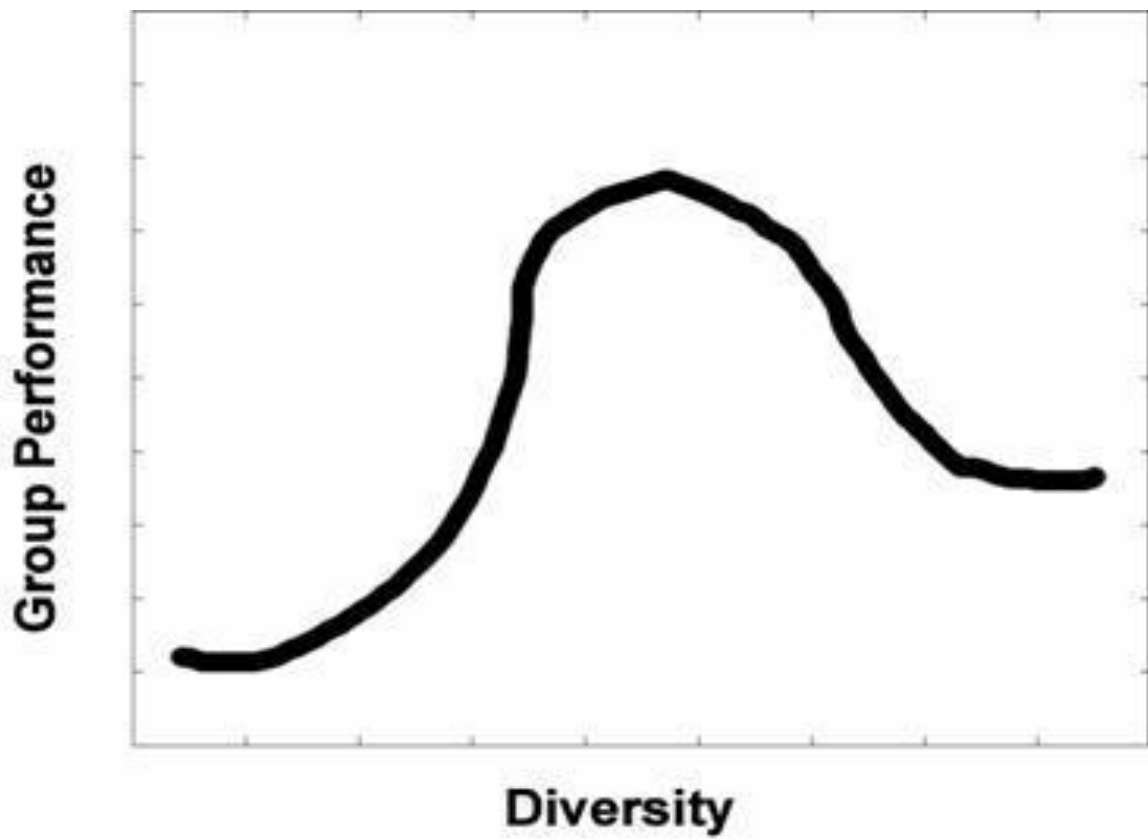


Figure 1. Curvilinear Relationship between Group Performance and Diversity

Figure 2

Leader Behavior

Hersey-Blanchard Situational Leadership® Model

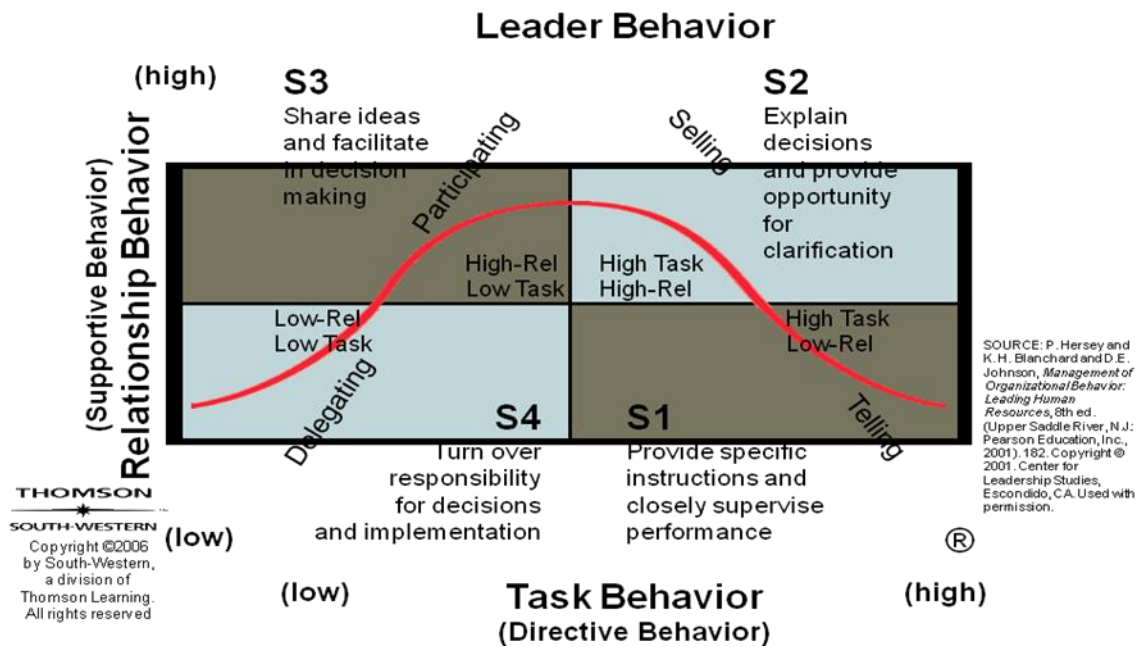


Figure 2. Hersey-Blanchard Situational Leadership Model

Figure 3
Follower Readiness

Hersey-Blanchard Situational Leadership® Model

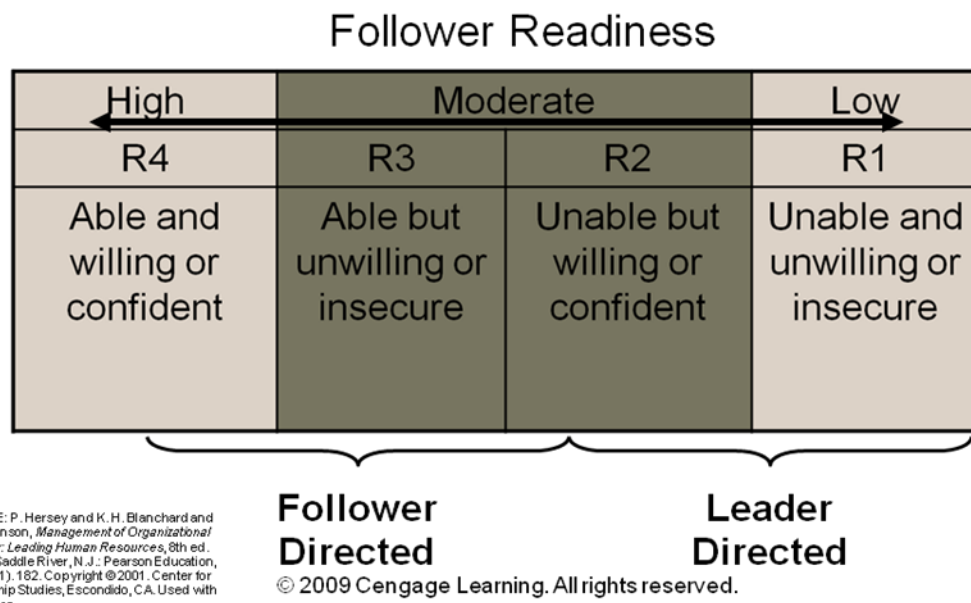


Figure 3. Hersey-Blanchard Situation Leadership Model: Follow Readiness

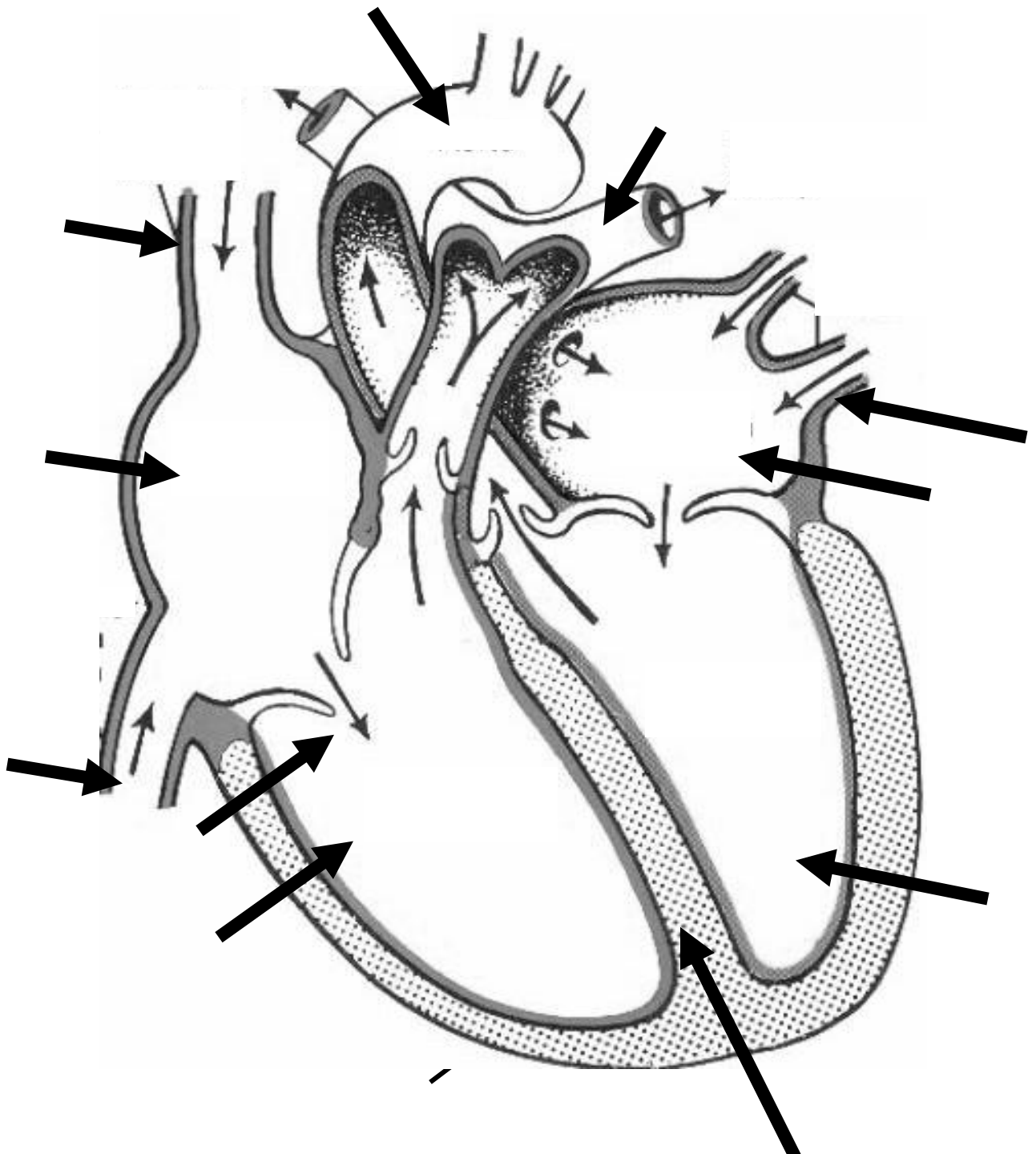
Appendix B

Heart Diagram

Name: _____ Date: _____

Circulatory System Diagram

Directions: Label each part of the heart. Trace the flow of blood through the heart using blue to indicate oxygen poor blood and red to indicate oxygen rich blood.



Appendix C

Heart Rate Lab

Investigating Heart Rate

Name _____ Section _____

Activities

1. Sit in a chair for 1 minute. After the one minute, have your partner take your pulse for 15 seconds. Record the data in the table.
2. Stand at attention for 2 minutes. After the two minutes, have your partner take your pulse for 15 seconds while you are still standing. Record the data in the table.
3. Do jumping jacks for 1 minute. After 1 minute, have your partner take your pulse for 15 seconds while standing up. Record the data in the table.

Data Table

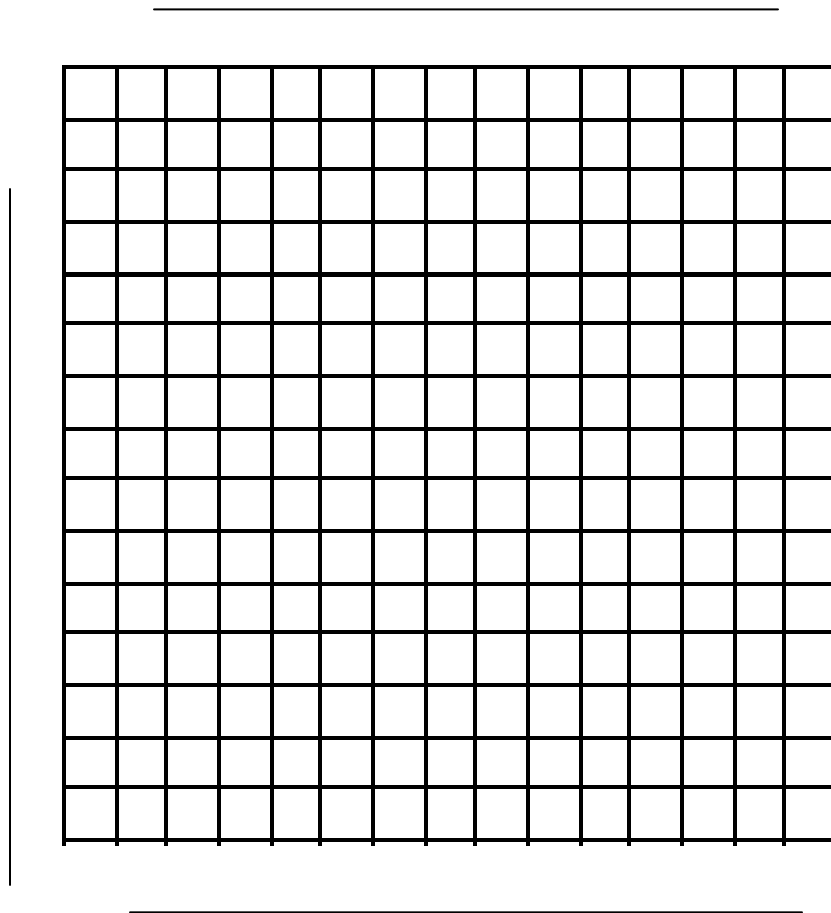
Activity	Pulse (15 seconds)		Pulse (1 minute)
Sitting (1 min.)		x4	
Standing at attention (2 min.)		x4	
Jumping jacks (1 min.)		x4	

To find your maximum pulse rate: $(220 - \text{age}) =$ _____

To find your optimal pulse rate: $(220 - \text{age}) \times .85 =$ _____

To find your minimum pulse rate: $(220 - \text{age}) \times .65 =$ _____

Construct a bar graph that shows your heart rate for each activity. Make sure to label all parts of the graph.



Make a generalization about the effects of exercise on your heart rate.

Why do you think the pulse rate of an athlete is less than the pulse rate of a non-athlete after exercise?

Appendix D

Circulatory System Center Worksheet

Name: _____

Date: _____

Circulatory System Micro slide Center

Slide 1.) Human Blood

Red Blood Cells (E) are the most common type of blood cell with about 25 trillion in the blood of an average man. They deliver oxygen to the cells and carbon dioxide away from the cells. They have no nucleus, but contain an iron compound (hemoglobin) which carries oxygen efficiently. White blood cells (L) help fight disease. One cubic millimeter of blood, a drop the size of this period, contains about 5 million red blood cells and about 7,500 white blood cells. Platelets (T) are tiny structures related to blood clotting. Plasma is over 90% water and carries dissolved materials to and from the cells.

a.) What is the purpose of a red blood cell? _____

Slide 3.) Artery and Vein

Blood flows in a continuous circuit in the body. The heart pumps it through arteries to the tissues, and it returns to the heart through veins. Each vessel is a "one-way road." ARTERIES always carry blood *away* from heart and VEINS always carry blood *towards* the heart.

This micro slide shows a small artery (A) and a small vein (V). You can clearly see how the artery wall is very thick, built of 3 layers. Veins are not as thick as arteries and do not contain 3 layers.

b) Which is thicker an artery or a vein? _____

c) Why would that blood vessel need to be thicker? _____

Slide 4.) Capillaries in the Lung

This micro slide of lung tissues shows a cross section of a small artery at A, and several capillaries are visible at C. They are so narrow that the blood cells must pass in single file. Food, water and oxygen diffuse out of the paper-thin capillary wall and reach the tissues. Exchange of materials between blood and the cells of the body can occur only in capillary networks

d) Why can the exchange of materials only happen in the capillaries?

Slide 5.) Valves

In this micro slide we see the valves (V) arranged in pairs opposite each other. They are loose pockets on the wall of the vessel. Valves (V) prevent blood from flowing backwards. There is a valve leading to the right/left ventricles from the right/left atriums.

e) Do the valves in this slide appear to be open or closed and why?

Slide 6.) Rat Heart

The rat heart is similar to that of a human heart. The right atrium (RA), left atrium (LA), right ventricle (RV) and left ventricle (LV) are all shown in the micro slide.

Right Atrium-Receives oxygen poor blood from the body

Left Atrium- Receives oxygen rich blood from the lungs

Right Ventricle-Pumps oxygen poor blood out of heart to the lungs

Left Ventricle-Pumps oxygen rich blood out of heart to the body

The septum (C) is the wall that separates the right and left sides of the heart.

f.) Write the order of how blood flows in and out of your heart on the line below:

Name: _____

Date: _____

Circulatory System Internet Center

Directions:

- 1.) Type in the following website:
<http://www.nlm.nih.gov/changingthefaceofmedicine/activities/circulatory.html>
- 2.) Read the “overview” paragraph labeled circulation station and answer the 2 questions below
- 4.) Click on “The Body’s Superhighway” tab and answer the question about the heart
- 5.) Click on step 2 and answer the questions (repeat until step 5)
- 6.) Click on “Complete the Loop” tab-read and answer the task questions by clicking on the picture
- 7.) Click on “A Doctor Making a Difference” and answer the 2 questions below

Circulation Station:

- 1.) What is the red blood cells specialized task?

- 2.) Your blood transports _____ back to the _____ where you can breathe it out.

The Body’s Superhighway:

- Heart- 1.) What are the functions of the heart (pump one, and pump two)?

- Lungs- 2.) Lungs allow _____ to pass into your blood when breathing in as well as letting _____ pass from your blood back out into the air.

- Arteries– 3.) What is the function of an artery?

- Capillaries – 4.) Why are capillary walls so thin?

Veins – 5.) Veins in your arms and legs have _____ which help

_____.

Complete the Loop: Click on the correct body part to answer the task questions.

A Doctor Making A Difference:

1.) How did Helen Brooke Taussig beat the odds of becoming a doctor?

2.) Dr. Taussig discovered “blue babies.” What was the cause of this?

Done??

Well type in this website <http://www.quia.com/jg/337933.html> and play some games!

Name: _____ Date: _____

Circulatory System Blood Donor Center

Question #1 (from page 1)

Read all 10 reasons to give blood and chose your top 3. Why did you choose them?

First _____

Second _____

Third _____

Why did you choose them?

Question # 2 (from page 5)

Read at least one passage of how someone who donated blood saved a life and write a reflection on how you feel. Would you donate blood to save a life?

Question # 3 (from page 6)

If you have a blood type of “0” you are called the “universal donor.” Why are you called this? And what blood type can use your blood if needed (use chart #1)

When you have completed these questions please look through all the pages on Blood Donation.

Blood Pressure

Name: _____ Date: _____

Circulatory System Blood Pressure Center

Read article on blood pressure and answer questions.

Blood pressure is the pressure of the circulating blood against the walls of the arteries, the veins, and the chambers of the heart. Blood pressure results from two forces. One created by the heart as it pumps blood into the arteries through the circulatory system. The other is the force of the arteries as they resist the blood flow.

Blood pressure, usually measured by an instrument called a sphygmomanometer is expressed in two figures.

- a) On contraction- the systolic pressure
- b) on relaxation- the diastolic pressure.

What is a healthy, normal blood pressure?

The blood pressure in the large artery of the heart, the aorta, and the other large arteries of a healthy adult is usually 120 mm Hg during the contraction of the heart (systole), and 80 mm Hg during relaxation of the heart (diastole). For adults, a normal reading can be anywhere from 120/70 to 140/90. Readings that are consistently 140/90 or above are considered high and would indicate the need for intervention. A good guide for blood pressure readings are; **Normal blood pressure** is less than 120/80, **High normal blood pressure** is between 120/80 and 140/90. **High blood pressure (hypertension)** is 140/90 or above. **Very high blood pressure (hypertension)** is 180/110 or above.

Blood pressure changes to meet your body's various needs.

- It is normal for blood pressure readings to vary throughout the day
- It is normal for blood pressure to increase during exercise and decreasing during sleep
- High blood pressure usually does not give warning signs
- You can have high blood pressure and feel perfectly well

Questions:

1. What is the name of the instrument used to measure blood pressure? _____

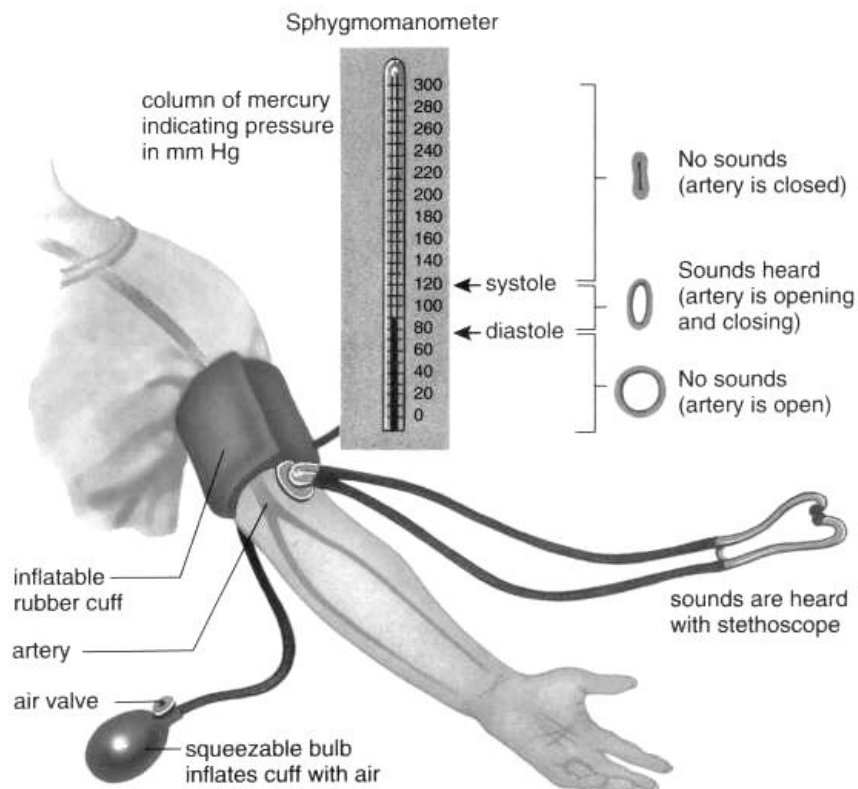
2. Your blood pressure can change when you are sleeping and when you are exercising. Why do you think that happens?

Sphygmomanometer

Name: _____ Date: _____

Circulatory System Blood Pressure Center

1. Place the cuff around your partner's arms and pull it tight. Place the Velcro down so the cuff stays on.
2. Make sure the valve on the pump is closed.
3. Place your stethoscope under the cuff on the front of the arm.
4. Pump the ball until the needle is at 180. **DO NOT GO HIGER THAT 140!!!!**
This collapses the major arteries to the arm (that's why it is uncomfortable).
5. Then you slowly release air by gently turning the air valve, and watch the pressure drop. When you first hear a sound that will be the **Systolic** blood pressure. The sound you hear is the blood now flowing in the artery of the arm.
This means that the systolic pressure is now greater than the pressure in the blood pressure cuff.
6. As you continue to watch the pressure drop, when you no longer hear any sounds, That will be the **Diastolic** blood pressure.



Appendix E

Circulatory System Unit Exam Study Guide

Name: _____ Date: _____

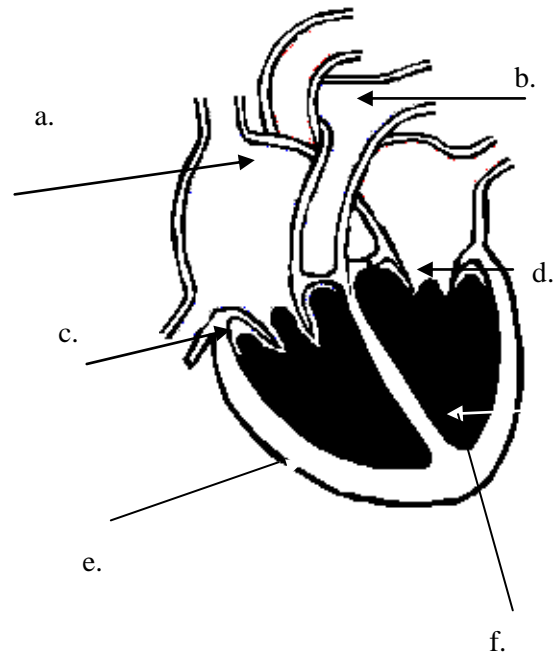
Circulatory System Review

1. List the blood path through the heart in order, starting with the vena cavae

Vena cavae _____

2. Label the parts of the heart.

a. _____
b. _____
c. _____
d. _____
e. _____
f. _____

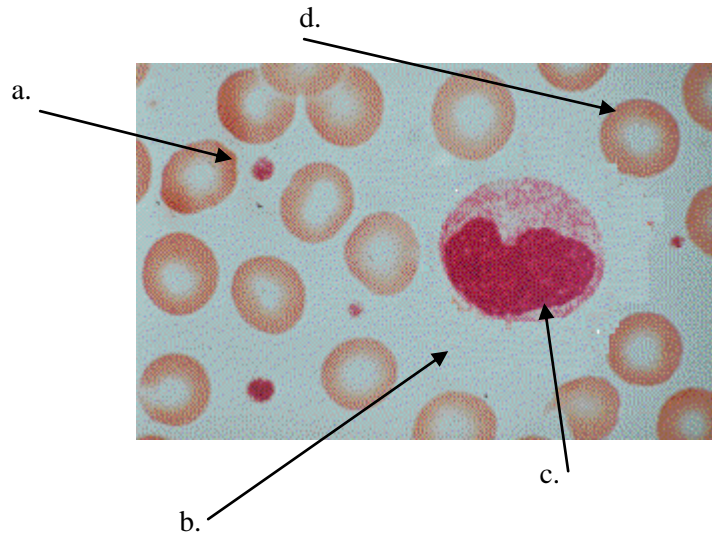


3. Describe whether the blood is oxygen rich or oxygen poor.

a. _____
b. _____
c. _____
d. _____
e. _____
f. _____

4. Label the parts of the blood.

- a. _____
- b. _____
- c. _____
- d. _____



5. Describe the function of the parts of blood.

6. Describe the role of the circulatory system in helping the body get rid of carbon dioxide.

Appendix F

Circulatory System Unit Exam

Name _____

Circulatory System Unit Exam

_____ 1. Which of these is NOT a function of the cardiovascular (circulatory) system?

- a) Controlling many body processes by means of chemicals
- b) Carrying oxygen, glucose, and other materials to cells
- c) Attacking disease-causing microorganisms
- d) Carrying waste products away from cells

_____ 2. The function of the atria is to

- a) Pump blood to the body
- b) Deliver oxygen to body tissue
- c) Receive blood that comes into the heart
- d) Pump blood to the lungs

_____ 3. Blood vessels that carry blood away from the heart are called

- a) capillaries
- b) lymphatic vessels
- c) arteries
- d) veins

_____ 4. What causes blood pressure?

- a) The speed at which oxygen is returned to blood in the lungs
- b) The force in which the ventricles exert on the arteries
- c) The strength of the muscles in the walls of the capillaries
- d) The speed at which blood flows from the atria to the ventricles

_____ 5. If a person's blood lacks platelets, what process could not take place?

- a) Carrying oxygen to cells
- b) Carrying glucose to cells
- c) Clotting of blood
- d) Transfusing blood

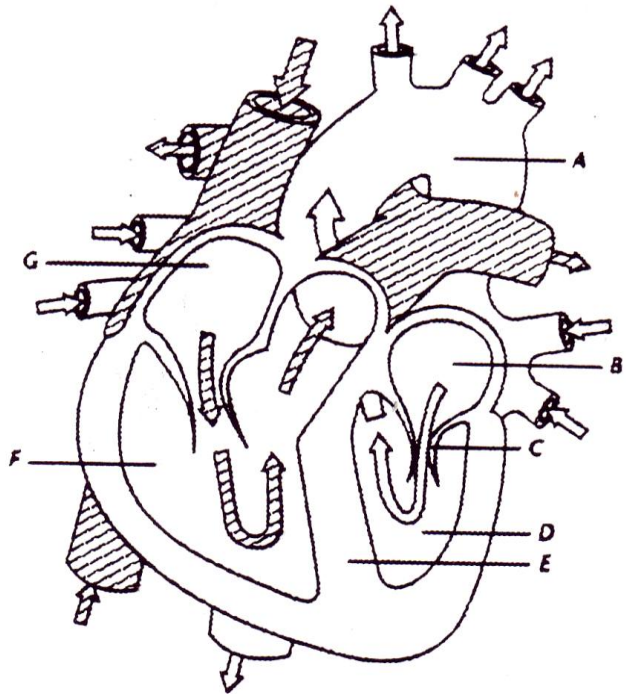
6. What would happen to your body if you did not produce white blood cells?

7. What would happen if your red blood cells did not contain hemoglobin?

8. Label the heart diagram using the word bank below.

Left atrium Aorta Right atrium Right Ventricle Left ventricle Valve Septum

- a) _____
- b) _____
- c) _____
- d) _____
- e) _____
- f) _____
- g) _____



9. What would happen if there was a hole in structure E? _____

10. What is the name of the blood vessel that brings deoxygenated (oxygen poor) blood to the lungs?

11. What is the name of the blood vessel that brings oxygenated (oxygen rich) blood to the heart?

12. Oxygenated / Deoxygenated (circle one) blood enters the right side of the heart.

13. Veins have _____ that keep blood flow from backing up.

14. Nutrients and oxygen enter the cells from the capillaries through _____

Appendix G

Ability Grouping Data Collection

Class A: Ability Grouping Data Collection

	A1	A2	A3	A4
Self-Esteem				
Self-Efficacy				
Quality of Discussion				
Instances of Leadership				
Other				