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# The construction of effective cooperative learning groups for successful high school biology instruction

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# THE CONSTRUCTION OF EFFECTIVE COOPERATIVE LEARNING GROUPS FOR SUCCESSFUL HIGH SCHOOL BIOLOGY INSTRUCTION

by
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ABSTRACT

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The purpose of this project was to determine the effect of balancing learning styles in the construction of cooperative learning groups. The investigation attempted to determine if science instruction and subsequent achievement can be enhanced by establishing effective cooperative learning groups. The Learning Style Inventory was used to determine learning styles. Then groups were formed based on either construction of balanced or unbalanced cooperative learning groups. Students then completed group activities as contained in the Celebrate Immunity Team Pack. Pre test and post tests were administered in order to measure cognitive gains. A statistical analysis of the results of the groups showed a significant difference in post test scores in one group of students whose groups consisted of a balance of learning styles. In another class that consisted of an imbalance of learning styles no statistical significance was found in their post test scores. This was as expected. Group construction must consist of students who can work together effectively. In determining learning styles, this balance can be achieved. However, in one group of students which consisted of groups of balanced learning styles, no statistical significance was found in their post test scores. They did show an increase in their post test scores, but further study is needed to determine what other variables determine the construction of effective learning groups.

## MINI-ABSTRACT

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The purpose of this project was to determine the effect of balancing learning styles in the construction of cooperative learning groups. Students were placed in either balanced or unbalanced learning style groups and completed the Celebrate Immunity Team Pack activity. In one group consisting of balanced cooperative learning styles, significant results were obtained in post test scores. However, further studies must be done to determine other variables involved in group instruction.

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# The Construction of Effective Cooperative Learning Groups for Successful High School Biology Instruction

## CHAPTER I

## INTRODUCTION

Cooperative learning is a term that refers to instructional methods in which students of all levels of performance work together in small groups toward a common goal (Slavin, 1982). Cooperative learning has been suggested as the solution for a large array of educational problems. It is often cited as a means of emphasizing thinking skills and increasing higher-order learning and as a way to prepare students for an increasingly collaborative work force (Slavin, 1991). However, for enhancing student achievement, questions remain as to what makes some cooperative groups more effective. To define what is meant by an effective cooperative group, instructors can measure the product of the cooperative learning team in the solution of a problem or an instructor can measure the learning that was accomplished as a team. Another aspect that can determine the effectiveness of the cooperative learning group is the amount of time on task. Some assessment of cooperative learning groups can also be determined by student self assessment forms of the amount of their learning and their interpretation of the group's accomplishments. Measurements of learning are primarily based on an individual's improvement over past performance (Sharan, 1994). Since science instruction has often used group lab activities as its basis for instruction, a question which arises from a discussion of cooperative learning is: Can science instruction and subsequent achievement be enhanced by establishing effective cooperative learning groups? A factor that contributes to effective group placement includes knowledge of learning styles. What are these styles? How can they be determined? Do they interact in cooperative learning groups? These questions must be answered. The concepts of cooperative learning, cooperative learning in science instruction, learning styles, and factors which contribute to establishing effective cooperative learning groups will be examined in this paper.

# CHAPTER II

## REVIEW OF RELATIVE LITERATURE

### Studies of Cooperative Learning

Historically, the beginnings of cooperative learning involves principles formulated by John Dewey, the primary philosopher of education in our society (Sharan and Sharan, 1992). Dewey believed that learning should be an active process that provided the learner with reference "to some possible living to be done in the future" (Sharan and Sharan, 1992). Dewey believed that experience in school should prepare students for life in the adult world. Cooperative learning creates conditions that allow students to identify problems, plan problem solving procedures, collect relevant data and solve the problem. However, actual implementation of instruction in many classrooms is the assumption that students' minds are blank tablets upon which the teacher must inscribe information (Sharan and Sharan, 1992). Hearing about a topic without any experience with its real use in the world is an inadequate basis for meaningful learning. Group investigation attempts to change this pattern and involves students as active participants in the process of learning ( Sharan, 1992). They will learn by asking questions, obtaining information, and interpreting the information in reference to their experience.

However, before practical cooperative learning programs began in the schools, social psychologists studied extensively the topic of cooperation versus competition. Several facts were discovered. The cooperative learning group was able to develop higher level skills. More and better ideas were developed. Problem-solving behavior improved and most importantly it was also discovered that when individuals worked together, they learned to like one another (Slavin, l982). Actual research on the implementation of cooperative learning in the classroom began in l970. Some of these early studies were conducted by Slavin (1982); De Vries & Edwards (1978); and Johnson (1974). The achievement of students in cooperative learning groups has been measured. Outstandingly large gains were observed in math classes by De Vries, and in 23 studies of the Johns Hopkins Student Teams Learning Methods, 17 studies showed significantly positive findings and in no cases did results favor the control group (Slavin, 1982). Student Teams-Achievement Divisions (STAD), the most extensively researched of all cooperative learning methods, has been identified as very adaptable and has been used in mathematics, science, social studies, English, and many other subjects and at grade levels from second grade to college (Sharan, 1994). In STAD, four member learning teams work to make sure all team members have mastered the lesson. When individuals are tested, their scores are compared to past averages. Bonus points are given to the team whose members show the most improvement. Students are motivated to not only learn the material themselves, but to help others master skills. Substantial differences favoring STAD have been found (Sharan, 1994). In addition to achievement, other factors that also improved were race relations, self-esteem, attendance and behavior (Slavin, 1991).

In order to successfully implement cooperative learning in the classroom, teachers need to understand the essential elements of cooperative learning. Simply placing students in groups and telling them to work together does not necessarily result in cooperative efforts (Sharan, 1994). The five essential elements of cooperative learning according to Sharan (1994) are as follows:

1. Positive interdependence: This is the idea that you cannot succeed unless others in your group also succeed.
2. Face-to-face promotive interaction: This is maximizing opportunities for students to promote other students' success.
3. Individual accountability: This exists when each student is assessed and students learn how the group affected better learning.
4. Social skills: Persons must be taught the social skills for cooperation.
5. Group processing: Groups need to learn how to achieve goals and must be given time to analyze how their learning groups are functioning.

When these basic elements are established, cooperative learning will work for all types of students including high achievers. Teachers or parents sometimes worry that cooperative learning will hold back high achievers. Research provides absolutely no support for this claim. High achievers gain from cooperative learning because we learn best by describing our state of knowledge to others (Slavin, 1991).

One study which demonstrated the effectiveness of cooperative learning involved the use of Group Investigation. In a class using the cooperative group investigation method, four interrelated dimensions are involved. The class functions as a set of small groups(dimension 1). The learning task is of a divisible and/or investigative nature. It deals with multifaceted problems (dimension 2). Pupils exchange information and gather information using an active-constructivist approach rather than the passive-receptive approach in a traditional classroom (dimension 3). The teacher acts as a facilitator and as a resource rather than dispenser of information (dimension 4)(Sharon, Hertz-Lazarowitz, and Schacher, 1981). The study of cooperative learning using Group Investigation illustrated how students can accelerate their learning rates. Social studies teachers compared the classroom interaction and academic achievement in these classes with the "whole-class" method. In Israel where the study was conducted, students of Middle Eastern origin generally belong to the disadvantaged population, whereas students of European-origin generally are more advantaged. Students from both origins were mixed in the classes studied.

Sharan and Sharan (1992) found that the students of Middle Eastern origin achieved average gains of two-and-a-half times those of their whole - class counterparts. The "socially disadvantaged" students taught with Group Investigation learned at rates above those of the "socially advantaged" students taught by teachers who did not use Group Investigation. For the students of Western origin, the average gain was twice that of their whole-class counterparts. The use of Group Investigation was exceptionally effective for both advantaged or disadvantaged, and, as it turned out, students from both backgrounds were disadvantaged in classes where cooperative learning was not used (Joyce,1991).

In addition to benefiting high as well as low achieving students, cooperative learning can enhance an instructor's teaching. When teachers release some control over learning situations and share the responsibility for learning with their students, a dramatic release of creative potential can occur for both (Davidson and O'Leary, 1990). In fact, when teachers share their knowledge about learning and thinking with students, it helps students become better learners. Some teachers have observed that when they explain the learning principles on which class activities are based, students begin to sense their own potential and become more active in their own learning. Some classes even offer suggestions for how the class could be revised the following year (Redding, 1990). This student involvement in the learning process is another goal of cooperative learning. In fact, in the Empowering Learners Project, students actually learn which behaviors and attitudes intensify learning and which inhibit it. "Part of the project involved (1) making students aware that different people have different learning styles and strengths and (2) helping them recognize their own strengths and develop additional ones" (Redding, 1990). It is one of the purposes of working in small cooperative groups that students learn from and help one another, not only in learning content, but also in developing learning strengths (Redding, 1990). Teachers can encourage students to teach each other from their own perspective. For example, a visual learner might prepare a chart, an auditory learner can explain orally and a kinesthetic learner can show a working model. This would improve learning for all students with varying styles.

Not only does cooperative learning improve actual classroom learning, but the interpersonal and group skills developed provide greater employability and career success (Johnson and Johnson,1990). The Center for Public Resources found that 90 percent of individuals who had been fired from their jobs were fired for poor job attitudes and inappropriate behavior (Johnson and Johnson, 1990). The ability to work effectively is essential. In cooperative learning, students learn the interpersonal and small group skills that will allow successful job performance. However, these skills must be taught just as systematically as any subject. Teachers must communicate to students the need for social and communication skills, and teachers must have students practice and perform these skills to ensure that the skills are mastered (Johnson and Johnson, 1990). However, for successful implementation of cooperative learning, teachers must also not only be adequately trained, but they must also participate with a commitment to integrate role changes within their teaching styles. In a study of the use of Jigsaw, the hypothesized affective benefits of cooperative learning were not produced (Sharan, 1990). Jigsaw is a cooperative learning strategy whereby students teach part of the curriculum to a small group of peers with an element of required interdependence.

An explanation for the failure of the strategy to improve self esteem and to increase mathematics achievement may have been due to weak implementation of the strategy. Quality Jigsaw implementation requires role changes that may be too radical for many teachers to integrate into their teaching styles. Many teachers substantially modified the Jigsaw Strategy by eliminating what may have been critical components necessary for effective use (Moskowitz, 1983).

Some of the conflicting results on effects of cooperative learning may be due to the fact that not all forms of cooperative learning are instructionally effective (Slavin, 1988). According to Slavin, two conditions are essential if the achievement effects of cooperative learning are to be realized. There must be a group goal that is important to all members of the cooperative group and there must be individual accountability. Some explanations of these requirements are that group goals are necessary to motivate students to help one another learn. Without individual accountability, one or two group members may do all the work; group members perceived to be low achievers may be ignored if they offer suggestions or ask for help. Group strategies should involve learning that requires students to take on subtasks within the group. This bases individuals' evaluation on the group's product or report. In this way there is a group goal with individual accountability (Slavin, 1988).

Studies of Cooperative Learning in Science Instruction

The previously cited studies are concerned with advantages and various strategies involved in cooperative learning. They do not address the particular advantage or uses of cooperative learning in science instruction. The following research concerns the issues of effective science instruction using cooperative learning groups.

One of the first studies conducted in which the cooperative approach and its effect on students' on-task behavior in secondary science was conducted by Lazarowitz, Hertz, Baird, and Bowlden in 1987. According to Slavin(1982) group learning increases the time involved in the task structure which is the sum of all activities involving the learning experience. In the Lazarowitz study, the instructional process (cooperation vs. the individualized mastery learning approach) served as the independent variable, and students' "on-task behavior" and academic achievement were the dependent variables. The results indicated that the experimental group displayed larger amount of student on task behavior than did the control group. The results of academic achievement, however, were not as clear. Two units were taught and in one learning unit: "The Cell," students in the cooperative group did significantly better than the control group. In the unit "Plants," students in the control group scored higher. However, the cell unit was more investigative in nature and required more inquiry. The plant unit involved more information gathering and it may be that differences in the kind of material to be learned required different tasks for effective cooperative learning (Lazarowitz, 1988). However, other findings of the study included lower rates of absenteeism. This may reflect students' satisfaction with the way science instruction was presented.

Another study on effects of cooperative learning on both academic achievement and social gains showed that students with different abilities and social status can learn effectively in a heterogeneous group under a cooperative mode of instruction. Academic gains were achieved in students with all levels of abilities including struggling students who were perceived by some students as low status (Baird, 1992). All students reported a gain in number of friends, and this research suggested that peers are capable of handling individual differences within their groups and of creating a positive support system for all participants (Baird, 1992).

Another aspect of effective science instruction is the incorporation of technology into the classroom. The technology revolution has given cooperative learning an even stronger imperative (Strommer,1995). Workers need to not only work together, but work together using technology such as the computer and the Internet. Students can actually communicate "on-line" with scientists and researchers in the midst of a group investigation. Students don't merely learn the facts of science. They can become a scientist. This involves teachers empowering their students to become designers of their own collaborative projects. An essential strategy to allow student interaction with technology is cooperative learning(Strommer, 1995).

Cooperative learning works ideally not only with technology but with the hands-on science that is essential for science instruction. Cooperative learning is structured so that students, not teachers, handle the materials. It is this hands-on approach to science instruction that allows the development of scientific knowledge. (Hannigan,1990). Educational technology and cooperative learning provide settings where interactive learning can be emphasized.

An example of where interactive learning takes place is in a program called SPARCS. This program (Solving Problems and Revitalizing Curriculum in Science) is a partnership formed between students and faculty at the University of Nebraska-Lincoln and the science teachers of the Omaha Public schools (Johnson, 1994). The goals of this project called for increasing students' ownership in their education and removing conditions that alienate students from the study of science. The classroom implementation of this goal requires instruction where students actively work in collaborative work which culminates in visible, high-quality performances or demonstrations. Teachers begin instruction by asking questions about phenomena, rather than giving facts to be memorized, and students then investigate their questions. The teacher's role evolves from telling to coaching and mentoring. Since the SPARCS program began, voluntary enrollment in science climbed from 65 to 90 percent, student performance has increased, attitudes towards science have improved, and dramatic decreases in student referrals for misconduct during science classes took place (Johnson. 1994).

In another study of cooperative learning in science instruction, highly significant gains in knowledge of pregnancy, gonorrhea, herpes and AIDS were achieved through the use Team Packs (Small, 1995). This study was conducted by the Center for Cooperative Learning for Health and Science Education and took place in Alachua County, Florida. The goal of the Team Packs was to promote more responsible sexual behavior. The Team Packs consisted of two parts: The first part guides students, in groups of 4 , through a series of questions and answers in a way that encourages students to share information with each other and then check their information against authoritative answers. The second part guides the students in role playing. This component was utilized because of the work of Janis, who showed that to change behavior, one must get people to identify with the adverse consequences of that behavior, and that role play accomplishes this, while just learning facts does not (Small, 1995).

Results of the study showed not only a significant posttest score increase, but also showed students reporting an attitudinal change toward safer sex practices that was statistically significant (Small,1995). The study also reported overwhelming acceptance by students and unanimous and enthusiastic acceptance of the materials by the teachers who returned their survey forms. However, with the responding teachers and schools, there was a large amount of variation in the Student Post-Team Pack Survey and the Teacher Survey. This shows that the effectiveness and acceptability of Team Packs can be influenced by other factors. One factor may be the teacher and suggests the importance of good teacher training (Small, 1995).

However, a disadvantage of this study is the fact that no control group was established in order to determine the effectiveness of cooperative learning. Another variable that clouds interpretation of the value of the cooperative learning strategy is the issue of role playing. Did role playing or cooperative learning result in achievement gains? The pre and posttest student scores also show major differences. Questions arise as to the amount of effort students made in achieving gains in their test scores.

<u>Studies of Learning Styles</u>

Although the positive effects of cooperative learning are well established, there remain several controversies and problems relating to particular practices and even to explanations of its findings. There is the question of whether individuals who are predisposed to cooperation do better in a cooperative treatment. Racial differences in effectiveness of cooperative learning remain a perplexing problem ( Slavin, 1982). There are conflicting studies on achievement gains from cooperative learning. Some studies state low achievers gain the most, while other studies suggest high achievers gain the most. Studies need to be done on what constitutes an effective cooperative learning group and what skills are necessary for both teachers and students. One aspect involving effective cooperative group function is the fact that there are differences in learning styles among students. In fact, major school reform efforts have moved the issue of effective instruction to the forefront of education, and researchers have renewed their interest in learning styles. Learning style assessment can provide the basis for a more personalized approach to student placement and instruction (Keefe, 1990). Teachers who are knowledgeable about learning styles can share useful insights about learning strengths with their students. They can help students understand elements of their own learning styles (Redding, 1990).

What , in fact, is meant by learning style? There are several theories of learning styles. Keefe has suggested that learning style is a total configuration of cognitive, affective and environmental elements (Keefe, 1990). Other researchers have developed various learning styles paradigms by examining the learning process in terms of the ways individuals actually learn. Learning styles are closely interwoven with the total personality. Several learning style instruments are based on Carl Jung's theory of personality type. Jung postulated two functions for perceiving--sensing and intuition-- and two for making judgments-thinking and feeling (Keefe, 1990). He also proposed two orientations to concepts and tasks-introversion and extroversion. The Jungian based *Myers -Briggs Type Indicator,* for example, diagnoses learners' preferences for expressing values, perceiving meaning and interacting with the world (Keefe,1990). The development of a defensible learning style paradigm appears to be reflected in an individual's typical cognitive, affective and environmental functioning (Keefe, 1990). Many learning style researchers attribute learning style to experience, psychological, neurological, and physiological factors. Kolb and other researchers in cognitive and learning style, saw learning style as a cognitive style that manifests itself in the learning environment. In fact , structure in the learning environment also differentially affects individuals of varying cognitive styles. Kolb correlated scales on his *Learning Style Inventory* with learning situations rated by 144 Harvard MBA's as facilitative. He found that learning situations that were helpful to individuals varied with learning styles (Keefe,1990). *The Learning Styles Network Newsletter* has consistently published research reports citing data in which teachers, by teaching to learning style, have helped their students increase their academic achievement (Keefe, 1990).

However, in order to accurately diagnose learning styles in order to provide optimum instructional strategies, a valid learning style instrument needs to be developed. According to Ferrell (1983) a number of instruments designed to measure learning styles have been developed for use in the classroom with minimum concern for issues of construct validity. Those working with learning style have proceeded with the development of an increasing number of learning-styles instruments without a theoretical framework providing for a learning style paradigm that is acceptable to all in the field (Ferrell, 1983). In a study on learning style prepared for the National Association of Secondary

School Principals, Keefe (1985) defined learning style as consisting of three types of behaviors: cognitive, affective, and physiological/physical. It is Keefe's conceptualization which provides a framework for analysis and comparison of four learning styles instruments. The four instruments evaluated were the *Grashe-Riechmann Student Learning Style Scales*, the *Kolb Learning Styles Inventory*, the *Dunn Learning Style Inventory*, and the *Johnson Decision Making Inventory*. The results of Ferrell's study showed the factors comprising the four instruments represent behaviors that comprise a learning style. However, no one instrument taps all three factors of the learning style conceptualization. In order to be representative of the learning style paradigm, a factor match should be found. There were, in fact, some overlap in factors across the instruments, but the instruments were not measuring the same thing (Ferrell, 1983). Each of the four instruments were tapping only one or two areas of behavior that make up learning style. It should be possible to develop an instrument that taps all of these types of behaviors, and therefore more fully assess the entire learning style.

Recently Johnston (1994) has developed the *Learning Combination Inventory* basing it upon an interactive paradigm of cognition, conation and affectation. The *Learning Combination Inventory* confirms or expands upon what the learner has indicated on the forced choice inventory. The inventory identifies the learner's tendencies into a scale indicating that they either avoid or use the categories in the following combinations:

> Each learning combination has a double name:
> Sequential Processor/Methodical Organizer;
> Precise Processor/ Data Collector; Technical
> Processor/Independent Reasoner; and Confluent

> Processor/Intuitive Risk-Taker. The first half designates the learner's primary means of processing, while the second half suggests the nature of the learner's outward behavior (1994).

The Learning Combination Inventory (LCI) is a 28-item self report scale that is group administered. The LCI uses a 5-point Likert -type scale to assess the four schemas conceptualized by Johnston (1994); Sequential Processor; Precise Processor, Technical Processor, and Confluent Processor. The methods used to determine construct validity consisted of over 200 hours of observations and subsequent field tests, and the conduction of first order and second order factoral analysis produced an internal reliability by scale varying between .5630 and .7858 (Johnston, 1995).

According to Johnston (1995) " A learner who begins by processing information in a sequential manner will perform the task following a set structure and will feel a sense of success following each direction to a "T". A learner who uses precise processing based upon detailed data gathering will perform with careful accuracy and feel success when receiving written confirmation of achievement. A learner who begins with technical processing will perform using concrete reasoning and will feel success when given the opportunity to work autonomously, unencumbered by paper and pencil requirements. A learner who uses confluent processing will avoid conventional approaches and embrace unique ways of completing the task and will feel success when allowed the freedom to risk, fail and start again. "

The Learning Combination Inventory aids learners in identifying which of these combinations they are more likely to use. The interpretation of the inventory requires an individual to understand their learning orientation.

According to Johnston (1995) these include both "tendencies to use and tendencies not to use" these schemas. The instrument is designed not to label an individual but to assist the learner in identifying both his strengths and weaknesses. It is important to recognize how an adaptation of certain strategies will allow the learner to "unlock the will to learn" (Johnston, 1995).

Rationale

The review of the theory and research in cooperative learning and learning style suggests that a significant difference exists among some cooperative learning groups. How an instructor places students in groups has significant effects on self-esteem (Johnston, 1994). A question remains. Is there a relationship between synergistically balanced and non-synergistically balanced groups in science instruction? The study by Johnston (1994) established that the conative factor becomes a significant consideration in forming a heterogeneously structured cooperative learning group. The study raised the question, "How does the balancing of conative behaviors within a cooperative learning group affect the individual group member's self-esteem when participating in the group's completion of an assigned learning task?" (Johnston , 1994).

The groups were structured on the basis of balancing student cognition (I.Q., previous marking period grades); and affectation (self declared interest in the subject ) while establishing either a balance or an imbalance of the group's conative Action Mode(TM) as identified on the Kolbe Conative Index R . It was found that a significant association was found between the configuration of cooperative learning groups and levels of self esteem. The conatively synergistic group included a balance among the four Action Modes including insistent and resistant levels in all categories. The non-synergistic group, on the other hand, would not include a balance of the four categories. The synergistically configured learning groups reported a consistently higher level of self esteem than the students who were placed in non-synergistic groups (Johnston , 1994).

It is important that teachers who use cooperative learning as an instructional technique understand the effect the group's conative composition has on individual member's self-esteem and consequent academic success. It is also important that students understand how they can use their conative behavior to enhance both group and individual performance(Johnston , 1994).

It is, in fact, one aspect of the Learning Combination Inventory to measure conation in determining learning style. Another important aspect of the LCI is the ability to prescribe favorable learning conditions for each type of learner. In this way, each type of learner should be able to achieve maximum learning. Since each schema involves varying strengths and weaknesses, one aspect of effective cooperative learning would involve a combination of each of the four learning combinations. Each group would consist of one person from each of the four schemas conceptualized by Johnston (1994); Sequential Processor, Precise Processor, Technical Processor, and Confluent Processor. In this type of group structure, the various individual assets should allow for the maximum learning and productivity by the cooperative learning group. According to Johnston (1995) the Sequential Processor in the group will organize, plan the work carefully and double-check the group work. The Precise Processor will ask specific questions to find out more information. The Technical Processor will figure out how to do things and build something as way of doing the assignment. The Confluent Processor will use imaginative ideas and unusual approaches to complete an assignment. These four schemas together will effectively complete the group assignment.

# CHAPTER III

# DESIGN OF THE STUDY

Rational:

It is the role of the teacher to instruct her students in identifying what their learning styles are and how they can most effectively utilize their strengths. As educators continue to meet the needs of a diverse student population, effective instruction requires responsive instruction. Knowledge of learning styles should make educators and learners successful partners. This successful partnership will be realized in the formation of synergistically balanced cooperative learning groups.

Hypothesis

Students placed in synergistically balanced cooperative learning groups and instructed on the use of their learning style will achieve higher post test scores, and will rate their cooperative learning group as valuable to their overall improvement in biology comprehension. Students not placed in synergistically balanced cooperative learning groups will achieve lower post test scores and will not rate their cooperative learning group as valuable to their overall improvement in biology comprehension.

Method : Testing of learning styles

This study will involve administering The Learning Style Inventory to three classes of students. The Learning Style Inventory is a copyrighted document and could not be duplicated for inclusion in this paper. In the three classes the inventory results will be scored in order to identify each student's learning style. To determine their learning style students will answer 28 questions about how they complete learning tasks. They will then score their answers by completing the scoring sheet which categories each answer as to the type of learning style their answers indicate they use. Students then plot their learning combination inventory in bar graph format which tells them which learning style they have a tendency to use and also what learning style they tend to avoid. Students will be instructed on how to interpret the learning style categories through the use of an interpretation guide reviewed in class. In addition, after learning style identification and discussion, each learner will be provided with strategies that will enhance learning. These strategies will allow the students to use their strengths most effectively and will also include strategies on how to enhance learning when styles they avoid are necessary. After learning style identification and discussion, students will be placed in cooperative learning groups consisting of groups with each of the four different learning styles represented. Each group will be made up of four students who represent each of the four learning styles. They are the following; sequential processor, precise processor, technical processor and confluent processor. In these balanced learning style groups each member can contribute a significant and effective strategy for learning. The sequential processor will review the directions and double check answers and develop an outline or plan for the group. The precise processor will check for accuracy of recorded information and will look up additional information to verify correctness and completeness of the information given. The technical processor will attempt to use mechanical ability in completing assignments and will tend to be the group manager. The confluent processor will begin the assignment immediately and ask for questions later as needed and will also often be the source of new ideas as to unique ways of solving the problem or group assignment. The control group will consist of cooperative learning groups randomly assigned with no balance of learning styles among the group members.

To determine the validity of the importance of identifying and representing each learning style in cooperative learning groups, the learners will complete a cooperative learning project. The task will require the deliberate use of all four learning styles. Materials involved will be Team Learning Packs titled "Celebrate Immunization!" Activities involved in the completion of the cooperative learning activity promote the knowledge of the necessity for immunization. A major problem in our country is the under utilization of vaccines in the very young and the elderly. In light of the recent federal Government Accounting Office report on the national immunization program, the most important factor in increasing immunization rates is an informed public (Small, 1995).

Determination of Pre Test Scores

In order to determine the effectiveness of the balanced cooperative versus unbalanced cooperative learning groups a pre test will be administered to all three classes. The Pre Test consists of 16 objective questions which measure knowledge about immunity, discoveries of famous scientists instrumental in our knowledge of immunity, disease transmission and effects of disease on the body. Scores will be compiled and saved for comparison to knowledge gained after Team Pack unit completion.

**Materials and Methods for Team Learning Pack Activity**

**Videos:**

"Why It Won't Happen To You" - Part I video looks at the effects of infectious disease on a polio victim. A polio survivor who has been paralyzed from the neck down tells students how he got the disease, the fear of polio everyone had, and how he has survived for the last forty years. The scientific discovery of the first polio vaccine by Dr. Jonas Salk is explained and compared to the later discovery of the oral vaccine discovered by Dr. Albert Sabin.

" Immunization: Who Needs It? - Part II video traces an actual measles epidemic and explains herd immunity. This video traces an epidemic to its origin. The numbers of individuals who contracted the disease and then brought the disease to other states is charted throughout the United States. These are actual disease statistics gathered by the Center for Disease Control in Atlanta, Georgia. The worse situation arose in an area where a victim of the original epidemic travels to her home school consisting of members of a religious order which do not believe in vaccination.

**Take Home Letter:**

Letter designed to involve older family members in the student's education, as well as to encourage adults to get needed immunizations is distributed to all members of all three classes. Students who return with the signed letter received five bonus points on their test grade. These points were not included as scores in the post test determination.

**Team Packs:**

Fighting Disease in 6 Rounds" - Printed Team Pack I

In this activity, each student (in teams of 4) plays the role of a famous doctor (Jenner, Pasteur, Sabin, or Salk). Students take turns by leading the discussion in order to share knowledge about infectious diseases in a cooperative learning mode. In the role-play activity students assume roles of doctors who made important contributions to vaccine development, and discuss the following issues; mode of infection of influenza, polio, AIDS, and tetanus-symptoms of influenza, polio, AIDS, and tetanus-treatment of influenza, polio, AIDS, and tetanus and finally, prevention of influenza, polio, AIDS, and tetanus.

General instructions to students are given prior to the role-playing activity. Icon cues on the role-playing sheets are explained so students know when they must speak and when recording of information is necessary. Then the students must collaborate in the completion of the disease data sheet. In this sheet students record what each scientist discovered. They also summarize how pathogens spread, where pathogens enter the body, symptoms, treatments, and prevention of particular diseases. Finally, each student diagnoses what each particular disease is based on the preceding information. Students also must complete short essay type questions concerning vaccines, disease eradication, and the differences between the oral and injectable polio vaccine.

"Immunization: Who Needs It?" - Printed Team Pack II

Again in teams of 4, students once more assume the roles of doctors (Jenner, Pasteur, Koch, and Von Behring), share information and work together to continue investigating vaccine development and prevention of infectious diseases. In this activity, students role-play Edward Jenner, Louis Pasteur, Robert Koch, and Emil von Behring, as they discuss their experiments. In the role-playing activities students learn the techniques Pasteur used in developing the anthrax, cholera, and rabies vaccine. They learn how Jenner was able to prove cowpox immunity also caused smallpox immunity. They learn the steps Robert Kock used to determine what particular pathogen caused a particular disease. The students are then aware of the importance of "Koch's Postulates". Students then recreate the steps von Behring followed in his discovery of antibodies in the serum of animals. After the discussion portion of the activity, students must complete a flow chart summarizing the preceding information on a flow chart. Students then complete a concept map outlining cause and preventions of infectious diseases. Students also must complete a vocabulary identification sheet and short essay type answers to discussion questions about possible complications with vaccinations and availability of vaccines( no AIDS vaccine is available and even though polio vaccine is available, in third world countries it is not readily available to the majority of the population). Rights of individuals and rights of the public in terms of immunity are also discussed. An important piece of information given is that many diseases have no effective treatment. Diseases such as AIDS depend primarily on prevention. It is hoped that awareness of the vital importance of vaccines will be developed.

**Post Test:**

The post test is similar to the pre test. It also consists of 16 objective questions which measure knowledge gained concerning knowledge in such areas as disease prevention, treatment, immunity, and discoveries of famous scientists who contributed to our concepts of immunity and disease eradication by herd immunity. See p. 34 and p. 40 for each test. The results of this study will be determined by statistically analyzing the differences in both pre and post scores for all groups.

**Cooperative Learning Group Evaluation Form:**

As a culminating activity students will be asked to evaluate their cooperative learning group experience. Students will complete evaluation questionnaires. They will be asked to not only evaluate the information they were involved in learning, they will also be asked to evaluate the effectiveness of their cooperative learning group. See Appendix B.

# CHAPTER IV

## PRESENTATION AND ANALYSIS OF DATA

Introduction:

This study was designed to determine if cooperative learning groups would be more effective if they consisted of a balanced representation of the four learning styles. The study involved determining the learning styles of three classes of students in academic biology. The first class consisted of the period 2 academic biology class. This class consisted of 22 students who were tenth grade academic or college prep biology students. The second class tested consisted of 22 students from the period seven academic biology class. They also were tenth grade academic or college prep biology students. The third class tested were the ninth period academic biology class. This class consisted of 22 students who were ninth grade academic biology students. These were students who took biology as ninth graders because of an accelerated track designed to allow more science instruction in high school. Many students in the third class were highly motivated and had higher CAT (cognitive ability test) scores. After all three classes had been given the Learning Combination Inventory, students determined their particular learning style. Based on answers to 28 questions about their learning styles, students were able to identify which learning schema they either used or avoided. Students were then instructed as to what each learning style was and how they preferred to learn information. Students were instructed on ways they could use their preferred styles as well as strategies that would help them in areas where they were weakest . Students in all three classes were then placed in groups of four. In all classes a few groups of three had to be formed. This was due to the fact that classes consisted of 22 students. Period 2 was randomly placed in cooperative learning groups. There was no balance of learning styles. Period 7 and period 9 were placed in cooperative learning groups with a balance of each type of learning styles. The groups consisted of one member of each of the four learning styles. The groups therefore consisted in one member who was a sequential processor, one member who was a precise processor, one member who was a technical processor and one member who was a confluent processor. Groups of three consisted of three different learning styles. All three groups were then given the assignment of completing the activities in the Celebrate Immunity Team Pack. Prior to this, all students were administered the pre-test. Scores were determined but these scores were not reviewed with the students . These scores were for the purpose of this study alone and did not influence their grade. Students then watched the video, did the role playing activity, answered the essay questions, and completed several sets of data sheets. At the completion of the group activity, students then were given a post-test which was graded and did count towards their grade. These tests were returned, discussed and a further assignment was given as a follow up to this activity. Students were assigned to complete a research paper dealing with unresolved questions dealing with immunity.

Results of Learning Style Inventory:

The following tables summarize the results of the learning style inventory. Each subjects primary learning style is listed and also the chart indicates if the student agreed with the evaluation based on the learning style inventory.

Table I

Period 2: Learning Style Inventory Results

| subject | learning style | comments |
|---|---|---|
| 1. | technical processor | agree |
| 2. | technical processor | agree |
| 3. | precise processor | disagree |
| 4. | technical processor | agree |
| 5. | technical processor | agree |
| 6. | sequential processor | agree |
| 7. | sequential processor | agree |
| 8. | sequential processor | agree |
| 9. | sequential processor | disagree |
| 10. | sequential processor | agree |
| 11. | technical processor | agree |
| 12. | technical processor | agree |
| 13. | sequential processor | agree |
| 14. | sequential processor | agree |
| 15. | sequential processor | agree |
| 16. | technical processor | agree |
| 17. | sequential processor | agree |
| 18. | sequential processor | agree |
| 19. | sequential processor | agree |
| 20. | confluent processor | agree |
| 21. | sequential processor | agree |
| 22. | technical processor | disagree |

Table II

Period 7: Learning Style Results

| subject | learning style | comments |
|---|---|---|
| 1. | sequential processor | agree |
| 2. | sequential processor | agree |
| 3. | technical processor | agree |
| 4. | technical processor | agree |
| 5. | confluent processor | agree |
| 6. | technical processor | agree |
| 7. | sequential processor | agree |
| 8. | technical processor | disagree |
| 9. | technical processor | agree |
| 10. | technical processor | disagree |
| 11. | technical processor | agree |
| 12. | technical processor | agree |
| 13. | sequential processor | agree |
| 14. | sequential processor | agree |
| 15. | sequential processor | agree |
| 16. | sequential processor | agree |
| 17. | technical processor | agree |
| 18. | sequential processor | agree |
| 19. | sequential processor | agree |
| 20. | technical processor | agree |
| 21. | confluent processor | agree |
| 22. | sequential processor | agree |

Table III

Period 9: Learning Style Results:

| subject | learning style | comments |
| --- | --- | --- |
| 1. | sequential processor | agree |
| 2. | sequential processor | agree |
| 3. | technical processor | agree |
| 4. | technical processor | agree |
| 5. | precise processor | agree |
| 6. | sequential processor | agree |
| 7. | technical processor | agree |
| 8. | sequential processor | disagree |
| 9. | confluent processor | agree |
| 10. | confluent processor | agree |
| 11. | technical processor | agree |
| 12. | sequential processor | agree |
| 13. | confluent processor | agree |
| 14. | confluent processor | agree |
| 15. | technical processor | agree |
| 16. | technical processor | agree |
| 17. | confluent processor | agree |
| 18. | sequential processor | agree |
| 19. | sequential processor | agree |
| 20. | technical processor | agree |
| 21. | precise processor | agree |
| 22. | confluent processor | agree |

These results indicate an overwhelming agreement of the assessment of learning styles which was determined by the learning style inventory. Where students disagreed with the assessment, their learning styles were a combination of several learning styles. In determining the learning style as indicated on the preceding charts only the learning style with the highest score was recorded. In many cases, individuals do use a combination of several learning styles. A very helpful aspect of the learning style inventory is that the learning styles avoided by the individual are also indicated. A practical application of the results of the learning style inventory is that students can be instructed in ways to complete the type of learning activities that give them difficulty. Students were given instruction as to what their learning style indicated. They were told how to try various strategies to make them better at certain activities. For some students, individual instruction would be necessary for complete understanding of the modifications they need in order to improve their learning strategies. There was not enough time for this to be accomplished.

Table IV

Pre Test:

The following is the sample of the pre test that was given to all three sections of biology classes. The answer key follows. This test was included in the Celebrate Immunity Team Pack.

Celebrate Immunization: Pre Test . Student Name____________

1-3 True of false:

1. Antibiotics are not effective treatment for most viral infections.
2. Treatment is better than prevention.
3. Antibiotics made by pharmaceutical companies are used to treat bacterial infections.

4-16 Multiple Choice: Choose The One Best Answer:

4. Which one of the following is an infectious disease?
   a. smallpox
   b. broken leg
   c. cleft lip
   d. cancer of the bone
   e. arthritis

5. Which one of the following is a non-infectious disease?
   a. influenza
   b. AIDS
   c. common cold
   d. measles
   e. diabetes

6. Which one of the following doctors discovered that there were antibodies in the blood?

    a. Jenner
    b. Pasteur
    c. Sabin
    d. Koch
    e. von Behring

7. Most people over 65 should get:

    a. a measles vaccine
    b. a DPT shot
    c. oral polio vaccine each year
    d. one pneumonia and a flu shot each year
    e. no immunization

8. In regards to smallpox vaccination scars:

    a. most grandparents do not have scars
    b. most parents over age 30 have scars
    c. most parents under age 20 have scars
    d. most children have scars

9. How did Dr. Jenner tell that people vaccinated with cowpox were immune to smallpox?

    a. them came from families that were immune
    b. they did not have smallpox scars
    c. he couldn't infect them with smallpox
    d. smallpox had already been eradicated

10. Which one of the following doctors was the first to discover that germs cause disease?

    a. Jenner
    b. Pasteur
    c. Sabin
    d. Koch
    e. von Behring

11. The polio germ:

    a. enters the body through a cut

b. grows in the skin
c. spreads to the lungs
d. can be killed with antibiotics
e. causes paralysis of he muscles

12. Which statement is true about AIDS?

a. Education people about how to avoid the virus is of no value.
b. There is no AIDS vaccine.
c. There is no treatment that cures AIDS.
d. The AIDS virus infects the respiratory tract and causes cough and runny nose.
e. The AIDS virus can be spread by contaminated food.

13. Which statement is true about influenza?
a. The influenza virus enters the body through sex.
b. Frequent hand washing during the influenza season does not help prevent infection.
c. The influenza virus causes symptoms including cough, fever, runny nose and sore throat.
d. There is no vaccine for influenza.

14. Tetanus or lockjaw:
a. enters the body through cuts
b. the bacteria grows in the lungs
c. has no vaccine
d. causes cough, fever and runny nose.

15. Infectious diseases cannot be caused by:
a. viruses
b. bacteria
c. fungi
d. parasites
e. genes

16. Choose the one FALSE answer. Infections can be prevented by:
a. being vaccinated
b. exercise
c. frequent hand washing
d. avoiding unprotected sex
e. avoiding cuts

Table V

Pre Test Answers:

1. B
2. A
3. A
4. D
5. B
6. A
7. D
8. A
9. D
10. D
11. C
12. C
13. E
14. E
15. C
16. C

Table VI

Pre Test Scores:

| Period 2 | Period 7 | Period 9 |
|---|---|---|
| 76 | 70 | 88 |
| 76 | 58 | 88 |
| 64 | 82 | 82 |
| 100 | 76 | 82 |
| 40 | 88 | 82 |
| 64 | 70 | 76 |
| 52 | 76 | 58 |
| 70 | 76 | 88 |
| 82 | 94 | 56 |
| 64 | 58 | 82 |
| 70 | 70 | 64 |
| 64 | 70 | 76 |
| 88 | 88 | 88 |
| 70 | 70 | 82 |
| 76 | 70 | 82 |
| 64 | 76 | 58 |
| 88 | 64 | 88 |
| 58 | 58 | 64 |
| 58 | 52 | 64 |
| 70 | 58 | 76 |
| 64 | 70 | 76 |
| 64 | 88 | 76 |

Analysis of Pre Test Scores

The mean value for period 2 were 69.18. The mean for period 7 was 69.73. The mean for period 9 was 76.18. When these scores were compared in an analysis of variance, the F values were not significant according to Duncan's Multiple Range Test. (See Table VII) This was as expected because all classes had not been given any instruction and had not yet participated in the group activity.

Table VII

ANALYSIS OF VARIANCE

| | DF | SS | MS | F |
|---|---|---|---|---|
| TREATMENT | 2 | 667.031 | 333.516 | 2.89ns |
| BLOCK | 21 | 3391.281 | 161.490 | |
| ERROR | 42 | 4839.625 | 115.229 | |
| TOTAL | 65 | 8897.938 | | |

F VALUE IS NOT SIGNIFICANT

C FACTOR= 339270.100

STANDARD ERROR OF MEAN (SX)= 2.289

DIFFERENCE BETWEEN TREATMENT MEANS 3.237

MEANS IN ASCENDING ORDER TO FOLLOW:
69.18 69.73 76.18

RANKS FOR MEANS (DUNCAN'S 5% LEVEL) FOLLOW:
1 TO 2 = A 2 TO 3 = B

DUNCAN'S 5%VALUES (2-3)
6.477 6.820

Table VIII

Post Test

The following is the sample of the post test that was given to all 3 sections of biology classes. The answer key follows. This test was included in the Celebrate Immunity Team Pack.

Post Test-Celebrate Immunization Student Name__________

1-3 True or False

1. Antibiotics are effective treatment for most viral infections.
2. Prevention is better than treatment.
3. Antibodies are made by the body after immunization.

4-16 Multiple Choice: Choose The Best Answer

4. Which one of the following is an infectious disease.
   a. high blood pressure
   b. obesity
   c. cancer of the ovary
   d. chicken pox
   e. diabetes

5. Which one of the following is a non-infectious disease?
   a. measles
   b. cancer
   c. polio
   d. tetanus
   e. gonorrhea

6. Which one of the following doctors proved that cowpox prevented smallpox and thereby discovered vaccination?
   a. Jenner
   b. Pasteur
   c. Sabin
   d. tetanus
   e. von Behring

7. Most children do NOT get immunized for:
   a. DTP (diphtheria, tetanus and pertussis)
   b. MMR (measles, mumps and rubella)
   c. Polio, either oral or injected
   d. Flu

8. Herd immunity means that in a community if:
   a. most people are immunized against measles, there won't be a measles epidemic
   b. all people are immunized against measles, there won't be a measles epidemic
   c. most people are immunized against measles, there won't be a flu epidemic
   d. all people are immunized against measles, there won't be a flu epidemic

9. The following doctor discovered the rules scientists use to prove which specific germ causes which disease:
   a. Jenner
   b. Pasteur
   c. Sabin
   d. Koch
   e. von Behring

10. Tetanus or lockjaw:
    a. is spread through the air
    b. is caused by a virus
    c. cannot be prevented
    d. causes muscle contractions

11. The polio germ:
    a. enters the body through sex
    b. grows in the heart
    c. kills the nerves that control muscles
    d. is treated with antibiotics
    e. causes the muscles to contract

12. Which statement is true about AIDS?
    a. The AIDS germ causes paralysis
    b. The AIDS virus can be spread by contaminated water of food.
    c. There is no effective treatment for AIDS.
    d. There is a good vaccine for AIDS.
    e. AIDS is caused by a bacteria.

13. Which statement is true about influenza?
    a. The influenza germ enters the body through a cut.
    b. The influenza germ causes paralysis.
    c. The influenza germ is a bacteria.
    d. There is no vaccine for influenza.
    e. Frequent hand washing during the influenza season helps prevent infection.

14. Germs cannot be spread through:
    a. sex
    b. the nose
    c. the mouth
    d. cuts
    e. hugs

15. Infectious diseases cannot be caused by:
    a. viruses
    b. bacteria
    c. molecules
    d. fungi
    e. parasites

16. Choose the one FALSE answer. Small pox has been eradicated. This means that:
    a. nobody will ever get smallpox again
    b. nobody will ever need to be vaccinated against smallpox again
    c. the virus can only be found in the soil, not in people
    d. the US saves millions of dollars each year because we don't need to vaccinate

Table IX

Post Test Answers

1. B
2. A
3. A
4. D
5. B
6. A
7. D
8. A
9. D
10. D
11. C
12. C
13. E
14. E
15. C
16. C

Table X

Comparison of Pre Test and Post Test Scores:

Period 2

| Pre Test Scores | Post test Scores |
|---|---|
| 76 | 82 |
| 76 | 100 |
| 64 | 64 |
| 100 | 82 |
| 40 | 82 |
| 64 | 82 |
| 52 | 64 |
| 70 | 94 |
| 82 | 88 |
| 64 | 94 |
| 70 | 82 |
| 64 | 70 |
| 88 | 100 |
| 70 | 70 |
| 76 | 70 |
| 64 | 70 |
| 88 | 82 |
| 58 | 70 |
| 58 | 70 |
| 70 | 76 |
| 64 | 82 |
| 64 | 76 |

Table XI

Comparison of Pre and Post Test Scores

Period 7

| Pre Test Scores | Post Test Scores |
|---|---|
| 70 | 64 |
| 58 | 76 |
| 82 | 70 |
| 76 | 100 |
| 70 | 88 |
| 76 | 92 |
| 76 | 82 |
| 94 | 94 |
| 58 | 70 |
| 70 | 88 |
| 88 | 88 |
| 70 | 94 |
| 70 | 88 |
| 76 | 70 |
| 58 | 76 |
| 52 | 64 |
| 58 | 82 |
| 70 | 88 |
| 70 | 70 |
| 64 | 94 |
| 70 | 70 |
| 58 | 70 |

Table XII

Comparison of Pre and Post Test Scores

Period 9

| Pre Test Scores | Post Test Scores |
|---|---|
| 88 | 94 |
| 88 | 100 |
| 82 | 76 |
| 82 | 94 |
| 82 | 100 |
| 76 | 88 |
| 58 | 94 |
| 88 | 94 |
| 56 | 100 |
| 82 | 100 |
| 64 | 94 |
| 76 | 94 |
| 88 | 100 |
| 82 | 94 |
| 82 | 100 |
| 58 | 70 |
| 88 | 100 |
| 64 | 88 |
| 64 | 88 |
| 76 | 100 |
| 76 | 88 |
| 76 | 76 |

Analysis of Post Test Scores

The mean value for the Post Test scores for period 2 was 79.55. This was a net gain of 9.37 points over the mean value in the Pre Test scores. The mean value for the Post Test scores in period 7 was 80.82. This was a net gain in 11.09 points over the mean value in the Pre Test scores. The mean value for the Post Test Scores in period 9 was 92.36. This was a net gain of 16.18 points over the mean value in their Pre Test scores. A statistical program using Duncan's Multiple Range Test analyzed the Pre Test Scores and the Post Test Scores. The statistical analysis of the three classes indicated that their was no significant difference in the gains made by either period 2 or period 7. However, the gains made by period 9 were statistically relevant. See Table XIII. An F value was determined to be 17.039. This indicates an F value that is significant at the 1% level. This test indicated their was no relevance in post test score differences between period 2 and period 7. There was a great deal of relevance in the difference in the post test scores in period 9. There are several possible reasons for the difference. One reason is that their cooperative learning groups were more consistently balanced. In period 7 absences forced several groups to change members. Another factor that may have contributed to the significant difference is that period 9 consists of ninth graders taking academic biology. Most of these students are placed in this class because of higher Cognitive Ability Test scores.

Table XIII

ANALYSIS OF VARIANCE

| | DF | SS | MS | F |
|---|---|---|---|---|
| TREATMENT | 2 | 2194.313 | 1097.156 | 17.039** |
| BLOCK | 21 | 3905.469 | 185.975 | |
| ERROR | 42 | 2704.344 | 64.389 | |
| TOTAL | 65 | 8804.125 | | |

F VALUE IS SIGNIFICANT AT THE 1% LEVEL**
C FACTOR = 468387.900
STANDARD ERROR OF MEAN (SX)= 1.711
DIFFERENCE BETWEEN TREATMENT MEANS= 2.419

MEANS IN ASCENDING ORDER TO FOLLOW:
79.55 80.82 92.36

RANKS FOR MEANS (DUNCAN'S 5% LEVEL) FOLLOW:
1 TO 2 =A 3 TO 3 =B

DUNCAN'S 5% VALUES (2-3)
4.842 5.098

# CHAPTER V

## SUMMARY

This project was an attempt to determine if more effective science instruction could take place if students were placed in cooperative learning groups that consisted of a balance of each of the four learning styles. The determination of students' learning styles was completed with significant student agreement of the assessment. Students were instructed as to what their style indicated. They were also instructed that each style had a significant value in the cooperative learning experience. Students were made aware that one students assets can compensate for areas of weaknesses that others may have. They were also made aware that there are several ways of completing assignments and that by working together more effective learning can take place. The overall atmosphere in the classroom during the learning style inventory completion was one of enthusiasm and student interest in the variables that affect their learning. They were genuinely pleased that a teacher would custom-make a lesson where everyone could contribute a critical part of the assignment.

The classes were all placed in learning groups and completed the Celebrate Immunity Team Pack. Overall, classes stayed on task, their was total involvement of all students and they were on task the entire period. The post test gains in all classes indicated that they all learned about immunity. The fact that the period 2 (unbalanced cooperative learning groups) and period 7 (balanced cooperative learning groups) did not show significant differences may be due to the fact that in period 7, several students who were absent had to change groups in order to complete the assignment. Another factor is that possibly this class has some students who are not academically suited for a college preparatory class. The other possibility exists that in this group activity not enough varied tasks exist to adequately require a balanced mix of the learning styles. The significant gains made by period 9 (balanced cooperative learning groups) verify that there was a valid difference in the achievement of this class. These students worked well together, enjoyed the activity and all responded favorably in their evaluation of their cooperative learning group. This class is also more academically motivated. Their test scores are usually much better then period 2 and 7. What actually does this study determine? All classes showed an improvement in post test scores, all students positively rated their cooperative learning experience. Period 9 which did consist of balanced cooperative learning groups showed statistically significant gains in scores. Is their gain due to a balanced cooperative learning group? I would like to think that was part of the reason. Further study is needed to adequately match classes with the same academic motivation and with similar cognitive ability scores. Then it would be more possible to show the relevance of balancing learning styles when making up cooperative learning groups. The fact that all students were provided with information on their differences in learning may have been a motivational factor in itself. Students need to know that teachers care about them as individuals. This did create a positive atmosphere in the class. Students enjoyed the activity and indicated they would like to continue group work as part of their learning activities in biology. As any teacher will notice, their is a difference in the effectiveness of some groups of students . What are the variables that determine the construction of effective learning groups? Much more research in this field is needed by educators who are interested in effective instruction.

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# APPENDIX

## PART A

Student Activities:

Discuss and complete answers to the following:

1. What is polio?
2. What is paralysis?
3. What is the cause of polio?
4. How does the polio virus enter the body?
5. How does polio spread from person to person?
6. Is there treatment for polio?
7. What is a vaccine?
8. Will the polio vaccine help fight other diseases?
9. What does eradication mean?
10. What is the difference between the injectable and the oral polio vaccine?
11. What is herd immunity?
12. Do some groups have herd immunity against measles?
13. Why do we care so much about measles?
14. Why isn't everyone in the world immunized?
15. Should the government require everyone to be immunized?
16. Develop a term paper topic that relates to an issue that has become part of your discussion. For example,what is the status of the development of the AIDS vaccine What are some dangers to vaccines? What are the reasons undeveloped countries lack vaccines? How can genetic engineering speed up vaccine development?

# APPENDIX

## PART B

Group Evaluation Form:

1-5 Answer yes or no to each question:

1. The work was divided evenly.
2. Each person did his share of the work.
3. Disagreements were settled fairly.
4. No one tried to dominate the group.
5. Write specific comments about your group below.

6-7 Answer as completely as possibly.

6. How would you change your group?
7. How did your group work as a whole?