Differentiated Component Approach to Cooperative Learning

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I. Introduction

It is the learner's activity that results in the learning. It is the function of the instructor to provide conditions that will increase the probability that the student will acquire the particular performance. That is to say, we cannot control learning but can only increase the probability that certain kinds of behavior will occur (Joyce & Weil, 1986, 429-431). Under proper conditions, emotional and intellectual growth could go hand in hand, and children could learn to like and trust each other in the course of their everyday learning activities (Aronson, Blaney, Stephen, & Snap, 1978, 18-23).

Classrooms are social settings inhabited by relatively large groups of students located in a room where a single adult serves as the instructor. Usually it is accepted that, without objection, the teaching belongs to the teachers and the learning belongs to the students. It seems that the basic conditions of schooling will not be changed radically in the near future. However, we can change the format of the teaching-learning process. "The challenge now is to design the instructional process for the existing classroom setting in order to reap optimum benefits for all of the people involved, adults and children (Sharan, 1990, 286)."

Cooperative learning in small groups has been shown to offer proper conditions for both social development and academic improvement. Aronson et al. asserted that it offers an atmosphere which is 'exciting and challenging without being threatening or anxiety-producing (1978, 18).' This statement reminds us of the famous 'democratic atmosphere' experiment

by Kurt Lewin and his students (Lewin, Lippit, & White, 1939). Lewin's creative experiments revealed that the group atmosphere influences upon individual behavior very powerfully. There is no doubt that Lewin's field theory, which emphasizes interdependence of realities in life space and social space, has provided the theoretical background for cooperative learning (Lewin, 1951).

Lewin's idea was expanded by his former student Morton Deutsch. Using field theoretical concepts, he theorized the cooperative and competitive social situation. In the cooperative social situation, any given individual can enter a goal region only if all the other individuals can enter their respective goal regions; whereas in the competitive social situation, if a goal region is entered by any individual, none of the other individuals can enter their respective goal regions. In other words, individuals in cooperative situations are promotively interdependent, whereas those in competitive situations are contriently interdependent (Deutsch, 1949, 461-463). Based upon the Deutsch's conceptualization, Johnson and Johnson (1974) defined the 'cooperative goal structure' as a social situation where the goals of separate individuals are so linked together that there is a positive correlation between their goal attainments, and the 'competitive goal structure' as one where the goals of separate participants are so linked that there is a negative correlation between their goal attainments. Consequently, within a cooperative goal structure, the individuals seek an outcome that is beneficial to all participants, but in a competitive goal structure, the individuals seek not only to succeed but also to cause other participants to fail. Johnson & Johnson criticized the several myths about competitive structure, and they indicated the superiority of cooperative goal structures to competitive ones in the cognitive areas as well as in the affective areas.

From the mid 1970s, several well-organized methods to implement the cooperative goal structure have been developed and utilized. The diversities among them are significant with regard to their characteristic implementations. Thus, it is not a good strategy to arbitrarily adopt one of them without full consideration of it. For the more desirable implementation of the cooperative goal structure, not only do we need to know under

what situation a certain element of cooperative learning methods is effective, but we also need to systematically and flexibly construct the set of elements and put them into practice. The differentiated component approach, which is being proposed by the writer, is an attempt to provide a systematic and flexible way to construct the cooperative learning environments.

II. Recent Methods of Cooperative Learning

Among the various methods of cooperative learning are, Aronson's Jigsaw, Johnson & Johnson's Learning Together, Sharan's Group Investigation, and Slavin's Student Team Learning have been most widely adopted by educators and have stimulated considerable research (Bohlmeyer & Burke, 1987; Bossert, 1988).

Jigsaw Jigsaw was developed by Aronson and his colleagues (Aronson et al., 1978; Aronson & Goode, 1980). The whole class is divided into small learning groups of about six members each. These groups are called jigsaw groups. "The material to be studied is divided into sections, one section for each person in the group. Thus, while the group as a whole possesses all important information about the subject to be studied, each individual has only one-sixth of that information. To learn the whole lesson the students must 'put the jigsaw puzzle together'; that is, they must master their own information so they can effectively teach it to the others in the group, and they also must help the other students teach their portions effectively (Aronson & Goode, 1980, 50)."

Success can be achieved only if members are paying attention to others, asking good questions, and helping each other teach. The most important factor for success is the feeling of responsibility as a team member. Thus, before learning substantive material, teachers are highly recommended to implement team-building exercises such as spending a few weeks teaching their students group-process skills and having them work in groups. Through learning the skills for communication and evaluating their group processes, students are expected to take responsibility for their own behavior. The

teacher is responsible for assigning students to a jigsaw group and for choosing a student as the group leader. In constructing the membership of a group, the following three factors are considered primarily: general scholastic ability, leadership ability, and affective bonds between students. Besides these factors, heterogeneity in terms of race and sex are also considered. Once a group is formed, the teacher acts like a 'floating' facilitator in that she is moving from group to group, observing processes and making suggestions.

There is a unique form of cooperative interaction among groups using Jigsaw. Students from different groups, but having the same material to learn, meet in counterpart groups to discuss their part of the task before attempting to teach the students in their jigsaw group. Participating in a counterpart group is useful for clear understanding and later presentation of the material. The time format of a typical jigsaw is that, if a class is to use Jigsaw an hour a day, twenty minutes of the hour should be spent in counterpart groups, and the remaining forty minutes in jigsaw groups. The last five minutes of the jigsaw group should be reserved for the group to discuss any problems that have arisen during the hour.

Learning Together Johnson and Johnson (1975/1991) outlined procedures for implementing cooperative, competitive, and individualistic goal structures in the classroom. Their procedure for implementing cooperative goal structures has often been referred to as the 'Circles of Learning,' because the class is arranged so that students in each group can sit in a circle facing each other, and they work collectively to complete a single worksheet or lesson. Learning Together emphasizes the intergroup cooperation as well as the intragroup cooperation. This method is sometimes referred to as the 'Pure Cooperation.'

Learning Together is based on the concepts that "Cooperation is not having students sit side-by-side at the same table to talk with each other as they do their individual assignments... Cooperation is much more than being physically near other students, discussing material with other students, helping other students, or sharing material among students, although each of these is important in cooperative learning. Five components must be included for small group learning to be fully cooperative

(Johnson & Johnson, 1975/1991, 55)." These five components include positive interdependence, face-to-face promotive interaction, individual accountability and personal responsibility, interpersonal and small group skills, and group processing (Johnson & Johnson, 1975/1991, 55-59).

The teacher's role includes the following five major sets of strategies: 1) clearly specifying the objectives for the lesson, 2) making certain decisions about placing students in learning groups before the lesson is taught, 3) clearly explaining the task and goal structure to the students, 4) monitoring the effectiveness of the cooperative learning groups and intervening to provide task assistance or to increase students' interpersonal and group skills, and 5) evaluating the students' achievement and helping students discuss how well they collaborated with each other (Johnson & Johnson, 1975/1991, 62-77).

Usually a teacher divides her class into groups of two to six students heterogeneous in ability, sex, race, and handicaps if applicable. Materials need to be distributed among group members so that all members are able to participate and achieve. To facilitate sharing within groups, a complete set of materials, information, or roles for a project is distributed to each group rather than to each individual. Group members then have to work together in order to be successful. After students are accustomed to collaborating with each other, the teacher may not have to arrange materials in any specific way. However, throughout the whole procedure, collaboration muse be emphasized in order to facilitate the feeling of 'sink or swim together,' or positive goal interdependence. Toward this purpose, each member should sign a paper indicating that he can explain why answers are appropriate, then the teacher may pick a member at random from each group to explain the rationale for their answers; or group rewards or grades may be given for group products, and bonus points may be given to each member of a group if all members reach a specified criterion. A second level of cooperation, or intergroup cooperation can be structured by giving the entire class a reward if every group reaches the stated criterion or by encouraging the members to help other groups complete the assignment.

Group Investigation The Group Investigation method of

cooperative learning was developed by Sharan and his colleagues (Sharan & Hertz-Lazarowitz, 1980; Sharan & Sharan, 1976, 1989-1990). This technique emphasizes interdependence among groups as well as interdependence among members within a group. In planning and carrying out a group-inquiry project, students progress through a series of the six consecutive stages: identifying the topic and organizing pupils into research groups, planning the learning task (or planning the investigation), carrying out the investigation, preparing a final report, presenting the final report, and evaluation (Sharan & Hertz-Lazarowitz, 1980, 20-42; Sharan & Sharan, 1989-1990).

A broad topic for the whole class is presented by the teacher. However, the identification and the selection of subtopics require cooperative planning by all students. Cooperative planning can proceed in various ways. The end product of ideas and suggestions is classified under a small number of categories. Classification is, in itself, expected to be an instructive experience for the students. The titles of subtopics are presented to the whole class, and then each student joins a research group according to his or her own interest. The teacher encourages the heterogeneity of ability, sex, and ethnicity within the group.

After joining their respective research groups, students turn their attention to the topic itself. At this time they have to formulate a researchable problem and set out a plan of action. Teachers need to help students become aware of the distinction between the tasks for gathering information and the tasks for investigation. To facilitate information gathering, learning stations are set up in various locations in the classroom. Learning stations can also be used to bring students into contact with topics their group is not currently studying. Teachers may set up a permanent location in the classroom, called a feedback center, where pupils can come for help from the teacher.

Carrying out investigation is the longest of all the stages. Group members gather information from a variety of sources, analyze and evaluate the data, reach conclusions, and apply their share of new knowledge to solving the group's research problem. It is most desirable that a group project not be interrupted before students have a chance to accomplish their task.

When information has been gathered, each group plans and presents a report to the rest of the class, and each student in the class is ultimately expected to learn all of the material. In assessing learning in Group Investigation, the teacher evaluates not only students' higher-level thinking about the topic but also their affective experiences. Moreover teachers are encouraged to make evaluation an on-going process by observing the investigative skills used by students throughout the project.

Student Team Learning Slavin (1980, 1991) described five kinds of cooperative learning methods which are collectively called 'student team learning (STL).' Three kinds of STL are general methods and the other two are subject-oriented methods.

The three general methods are Teams-Games-Tournaments (TGT) developed by DeVries & Slavin (1978), Student-Teams-Achievement Divisions (STAD), and Jigsaw II developed by Slavin (1980). These methods all emphasize the competition between groups as well as the cooperation among group members. Intergroup competition is emphasized. It is important that the groups be matched evenly according to their ability, and the teams should be balanced in terms of ethnicity and sex. Then, students are encouraged to help all members of their team master the lesson material so that their group can get the most points in an academic competition. The major reward for the winning team is the recognition by announcement in a class newsletter published weekly.

In STAD, the teacher introduces new material each week, and then team members study worksheets on the material. They may work problems one at a time, in pairs, take turns quizzing each other, discuss problems as a group, or use whatever means they wish to master the material. Team members are told that they have not finished studying until all members are sure they understand the material. Following team practice, students take quizzes on the material they have been studying, and then the individual scores are formed into team scores by the teacher. The amount each student contributes to his or her own team is determined by the amount the student's quiz score exceeds his or her past quiz average.

TGT uses the same instructional format and worksheets as

STAD. However, students in TGT play academic games to show their individual mastery of the subject matter. Students play these games in weekly tournaments in which they compete with members from other teams who are comparable in past performance.

The key to Jigsaw II, a modification of Aronson's Jigsaw, is interdependence, that is, every student depends on teammates who provide the information he or she needs to do well on the quizzes. Students are assigned chapters to read and are given an expert sheet that contains different topics for each team member to focus on while reading. When everyone has finished reading, students from different teams with the same topic meet in an expert group for about 30 minutes. They then return to their teams to take turns teaching their teammates about their topics. Finally, the students take quizzes that cover all the topics, and the quiz scores become team scores as in STAD.

The two subject-oriented methods are Team-Assisted Individualization (TAI) developed by Slavin (1985), and Cooperative Integrated Reading and Composition (CIRC) developed by Slavin and his colleagues (Stevens, Madden, Slavin, & Farnish, 1987).

TAI combines individual instruction with team learning for the teaching and learning of mathematics. Classes are divided into teams consisting of 4 or 5 students. Teams are heterogeneous by sex, race, ability, and handicapping conditions. Within teams, the students are divided into pairs or triads. Each student on every team is placed at the appropriate point in an individualized mathematics program. Although students work their own problems on worksheets, partners check each other's progress throughout the program. When students have questions, they ask for help from others within their team before asking the teacher. Students are given quizzes and final tests as they are ready for them. At the end of each week, team scores are computed based on the average number of units covered by the team members. Special recognition, in the form of certificates, is given to teams that reach criterion scores established by the teacher.

CIRC is a comprehensive program to teach reading and writing for the upper elementary students. CIRC has three principal components: basal-related activities, direct instruction in

reading comprehension, and integrated language arts and writing. All activities are done in heterogeneous learning teams, and follow a regular cycle: teacher presentation, teacher-guided practice with the group, team practice, independent practice, peer pre-assessment, and testing. Students are assigned to reading groups according to their reading level. Within each reading group, students are grouped into pairs or triads. Then, each pair or triad is teamed with another pair or triad from a different level reading group. Team members receive points based on their individual performances and a team score is formed from these individual points, ensuring individual accountability. Team rewards are usually certificates based on the average performance of all members on all reading and writing activities. Students have an equal opportunity for success because they can work on materials appropriate to their own ability levels.

III. Components of Cooperative Learning

The fundamental feature of cooperative learning is that all the group members are working together with positive goal interdependence, or a cooperative goal structure within which the success of any one member helps the other members to be successful (Bak, 1992, 8-9). Usually cooperative learning groups are composed of 2-7 members who are heterogeneous in terms of sex, race, ability level, or handicapping conditions. However, the fundamental feature itself is not enough for cooperative learning to be effective. It is necessary to manipulate additional elements in addition to goal interdependence. For example, Johnson, Johnson, and Stanne (1989) show that cooperative goal structure is effective only when resource interdependence is combined with it. The central issue of cooperative learning is how to efficiently implement cooperative learning environments.

A meta-analysis of Slavin (1983) concluded that cooperative learning enhances academic achievement only if it is implemented by group rewards and individual accountability. High reward interdependence means that there is an explicit group reward based on the group's performance. High individual accountability means that each team member's contribution to

their team score is separately quantifiable. Johnson and Johnson (1975/1991, 1990) argue that it is only in certain conditions that group efforts may be expected to be more productive than individual efforts. Those conditions include the clearly perceived positive interdependence, considerable promotive face-to-face interaction, a feeling of personal responsibility to achieve the group's goal, frequent use of relevant interpersonal and small-group skills, and periodic and regular group processing.

Recently, Bak reviewed the various cooperative learning methods and extracted the following elements as the potential components of cooperative learning (Bak, 1992, 17-18, 36-38): reward interdependence (the extent to which reward is based on the group performance), within-group and between-group resource interdependence (the extent to which each member or each group has only a portion of the information, resources, or materials necessary for the joint-task to be completed), within-group and between-group task interdependence (the extent to which each member or each group is assigned complementary and interconnected tasks/roles in order to complete a task), individual accountability (the extent to which each member's contribution to group performance is separately quantifiable, or the extent to which each member feels his/her own responsibility for the group work), individualistic incentive structure (the extent to which each member's reward is based upon his/her own performance), equal opportunity for success (the extent to which an individual's performances is determined by the improvement over his/her own past performance), teambuilding activities (the extent to which members are given time to develop social skills such as communication skills or cooperative skills), within-group and between-group group processing (the extent to which members are given time to talk about their group work with other members of the same group or with those from different groups), and intergroup competition (the extent to which a group reward is solely given to the highest scoring groups). Table 1 from Bak (1992, 38) shows how differently each cooperative learning method emphasizes or deemphasizes the above components.

Bak & Powell (1994) conclude that, among those components listed above, only individual accountability, individualistic

Table 1.
Degrees of implementing the potential components within each cooperative learning method

Potential components	Cooperative Learning Methods							
	JIG	LT	TGT	STAD	JIG2	GI	TAI	CIRC
reward interdependence	1	4	4	4	4	2	4	4
within-group resource interdependence	4	3	1	1	3	3	2	1
between-group resource interdependence	1	1	1	1	1	3	1	1
within-group task interdependence	3	2	2	2	3	4	2	3
between-group task interdependence	1	1	1	1	1	4	1	1
individual accountability	1	3	4	4	4	3	4	4
individualistic incentive structure	4	3	4	4	4	2	1	3
equal opportunity for success	1	2	4	4	4	1	3	3
teambuilding activities	4	4	1	1	1	1	1	1
within-group group processing	4	4	3	3	3	4	2	3
between-group group processing	4	1	1	1	3	4	1	1
intergroup competition	1	1	4	4	4	1	3	3

note. 1=no/little 2=low 3=middle 4=high

incentive structure, and team-building activities are positively related to the students' academic achievement. Reward interdependence is not related to achievement, intergroup competition has a highly negative relationship with achievement, and the other components need further investigation.

IV. Differentiated Component Approach to Cooperative Learning

The differentiated component approach is a systematic and flexible framework used to construct the cooperative learning environments. This approach is not a content-specific method, rather this approach is a generic viewpoint used to structure the elements of cooperative learning. This approach can provide the researchers with productive directions for their research to follow, and encourages practitioners to integrate the research and practice. The differentiated component approach starts from the differentiation of components from both moderators and

learning efforts are to bring the cooperative environments into the whole classroom as well as into the whole school (Kagan, 1985).

A study The idea to propose the differentiated component approach comes from the research results that the effectiveness of cooperative learning varies according to several moderators and that the cooperative learning methods, which emphasize different sets of components, are not equally effective for the students' development. For example, a recent meta-analysis reveals that the effects of cooperative learning fluctuate with the moderators of ability level, race, grade, school location, SES level, subject matter, task level, treatment duration, and group size; and that Learning Together is the most effective method for academic achievement (Bak, 1992, 48-59).

To get a more direct support for the diverse implementations of cooperative learning, the weighted multiple regression analysis was conducted by utilizing the meta-analytic data and procedures presented in Bak (1992, 30-42). For an accurate meta-analytic regression analysis, it is important to note that the computer printouts for the standard error and the p-value of the regression coefficients are incorrect, and thus they should be corrected (Bak, 1992, 42).

The computer program and its results are presented on Table 2. The predictors include nine components which are listed under the Table 2 and the criterion is the unbiased estimate of effect size from Hedges' formula (Bak, 1992, 39). The regression analysis was done on the levels of moderators which contain a relatively large number of cases for the analysis.

Table 2-2 vividly shows that the significant components for cooperative learning are very different according to the levels of moderators. Particular attention should be paid to the results that a certain component is not always positive for the students' development, but it can become significantly negative under certain situations. The results of the regression analysis strongly suggest that we need to implement a cooperative learning environment more systematically, more flexibly, and more cautiously.

Differentiation of Implementation Within the framework of

Table 2.

SAS program for the weighted multiple regression analysis and its results about the significant components of cooperative learning by moderators

Table 2-1. SAS program for the weighted multiple regression analysis

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DATA META; INFILE CARDS; .....
%MACRO WTREG(GRP); PROC SORT DATA=META; BY &GRP;
  PROC GLM DATA=META; BY &GRP; WEIGHT WT;
  MODEL ESD=REWRD RESRC ACCNT INCNT EQUAL TEMBD WNGRP
BTGRP CMPTN; RUN;
%MEND WTREG;
%WTREG(SCHL); %WTREG(ROLE); %WTREG(FEED); %WTREG(TASK);
```

Table 2-2. Results about the positively and negatively significant components by moderators

moderators		posit. sig. components	negat. sig. components
SCHL	elementary	REWRD	RESRC
	secondary	RESRC ACCNT TEMBD	WNGRP BTGRP CMPTN
ROLE	facilitator	RESRC INCNT TEMBD	CMPTN
	manager	ACCNT INCNT WNGRP BTGRP	RESRC TEMBD CMPTN
FEED	students	ACCNT INCNT WNGRP BTGRP	RESRC CMPTN
	both	RESRC INCNT TEMBD	WNGRP CMPTN
TASK	low	REWRD BTGRP	RESRC CMPTN
	middle	none	RESRC CMPTN
	high	REWRD BTGRP	EQUAL

note. criterion: ESD (unbiased effect size for the academic achievement).
predicting components: REWRD (reward interdependence), RESRC (resource interdependence), ACCNT (individual accountability), INCNT (individualistic incentive structure), EQUAL (equal opportunity for success), TEMBD (teambuilding activities), WNGRP (within-group group processing), BTGRP (between-group group processing), CMPTN (intergroup competition).
moderators: SCHL (school level), ROLE (teacher role), FEED (feedback source), TASK (task level)

the differentiated approach, cooperative learning is viewed as a dynamic set of paradigm from which we can continue to devise new structures for coping with the wide variety of instructional

needs. We should not rest content with the existing methods as if they were inviolable, but we could use them as building blocks for new combinations of procedures as the need arises; and whenever implementing the structures of components, we should evaluate the practices and, if needed, revise them (Sharan, 1990, 295-296).

The general procedure to implement cooperative learning by the framework of the differentiated component approach may be described as follows: 1) to define the targeted outcomes of instruction, 2) to specify the personal moderators, 3) to locate the mediators connected to the outcomes, 4) to specify the practice-wise moderators, 5) to construct the structure for the essential components, 6) to select a set of potential components, 7) to construct the structure for the potential components, 8) to integrate the structures of essential and potential components ones, and 9) to implement the integrated structure of components.

With regard to the preceding procedures, at least two serious questions might arise: how to locate the mediators and how to construct the structure for a specific component. To locate the mediators on the proper place, we need to form a causal chain from the components and the moderators to the outcomes, for example, the causal model of cooperative learning and achievement presented in Bak (1992, 78). It takes much time and expertise to construct the concrete structure for a specific component. Thus, as suggested by Kagan (1989-90), it must be very helpful for the practitioners to be able to have access to the source pools which contain a number of the ready-made structures for the implementation of specific components.

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