

PEER ASSISTED INSTRUCTION  
IN A MASTERY-BASED TEACHER  
EDUCATION COURSE: A STUDY  
OF THE LEARNING CELL

Dissertation for the Degree of Ph. D.  
MICHIGAN STATE UNIVERSITY  
ROBERT DAVIES STONE  
1974



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## ABSTRACT

### PEER ASSISTED INSTRUCTION IN A MASTERY-BASED TEACHER EDUCATION COURSE: A STUDY OF THE LEARNING CELL

By

Robert Davies Stone

The primary objective of this study was to design, implement, and evaluate a peer-based instructional strategy involving dyads of learners working together in an ongoing, competency-based, introductory level teacher education course. This peer-based instructional strategy, the learning cell, was defined as a dyad in which learners mutually teach and mutually learn from each other.

Both experimental and descriptive research strategies were pursued in the investigation. The original experimental design had three levels of the independent variable, learning procedure: (1) structured learning cell; (2) unstructured learning cell; and (3) control group. However, an unexpectedly large loss of experimental subjects resulted in a modified design that primarily consisted of two treatment groups, one composed of viable learning cells and the other composed of non-viable learning cells. A "viable" learning cell for a particular unit of study was defined as one in which at least

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one report (Activities Log) of a learning cell meeting was received from a dyad, a Unit Mastery Evaluation was taken by at least one dyad member, and only the same individuals worked together in the learning cell during the term.

It had been hypothesized that the addition of learning cell procedures to the standard auto-instructional options which were available in the course would (1) provide for more effective learning, (2) alleviate several course administrative problems, and (3) improve student perceptions of specific, as well as general, aspects of the course. However, a series of experimental tests indicated that there were no significant differences ( $\alpha=.05$ ) between treatment groups in respect to these general hypotheses.

The descriptive research phase of the overall investigation examined the characteristics and dynamics of learning cells as they operated within the natural educational environment provided by the course. Data were primarily collected through study logs and interviews with learners who had been selected for participation in the study. Results were presented in a series of topic discussions and in two detailed case studies of peer-assisted instruction. These results suggested that mutual learning and mutual teaching are critical elements for successful learning cell operations. The importance

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of adequate preparation, similar rates of study, active dialogue, and good interpersonal relationships was also evident.

It was concluded that investigations of the learning cell need to consider carefully the cognitive level of the learning task, the degree to which learning cell activities are structured, and the interpersonal relationships that exist between partners.

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PEER ASSISTED INSTRUCTION IN A MASTERY-BASED  
TEACHER EDUCATION COURSE: A STUDY  
OF THE LEARNING CELL

By

Robert Davies Stone

A DISSERTATION

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in partial fulfillment of the requirements  
for the degree of

DOCTOR OF PHILOSOPHY

Department of Counseling, Personnel  
Services and Educational Psychology

1974

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I would like to thank Christine Davidson, Marian Tesar, and Jane Payne for their assistance in the data collection for this study. Special thanks go to Ted Urban for his efforts in preparing these data for analysis.

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Finally, I would like to thank my wife, Joy, and children, Rob and Cindy, for the many personal sacrifices which they have lovingly made throughout my involvement in this investigation. Their inspiration, encouragement, assistance, and understanding are deeply appreciated.

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## CHAPTER I

### INTRODUCTION

In their book The Evolution of Physics (1938), Einstein and Infeld wrote:

A new concept appears in physics, the most important invention since Newton's time: the field. It needed great scientific imagination to realize that it is not the charges nor the particles but the field in the space between the charges and the particles which is essential for the description of physical phenomena (p. 259).

Out of this conception of the field in the space between the charges and the particles arose the theory of relativity--a theory that produced a major paradigm shift (Kuhn, 1962) in the physical sciences by modifying long-standing ideas about the laws of mechanics. During the years since its original formulation the theory of relativity has provided an important model for scientific thinking and inquiry about the nature of the universe.

Within the science of psychology, the theory of relativity was manifested in the Gestalt movement, receiving extensive articulation in Lewin's field theory (1935). The concept of the field in the space between has suggested an important model for the science of

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education as well, but as Mallinson (1969) observes, the model has been seriously neglected. According to him, education still emphasizes the particles, that is, persons, while denying the processes of interaction between these particles, or persons. Mallinson further suggests that most educators persist in viewing the process of learning as being almost unidirectional, a transaction that only proceeds from teacher to student. In its place, Mallinson proposes a mutual two or more person interaction system in order to restore to formal education what Buber (1947) identifies as being the fundamental fact of human existence--man in relationship to man.

Deutsch (1954) has pointed out that the impact of the theory of relativity in psychology is not due to the actual physical concepts it proposes, but rather its method of representing reality. In both education and psychology the field is the site of reality. But the method of these sciences must be used for exploration as well as representation, and in order to be productive, both uses must be congruent with one another (Snow, 1974). The results of highly controlled laboratory studies in education, as well as psychology, are of scientific interest, but they are often of little practical value until they are related to the field. Important educational phenomena frequently occur in the spaces between controlled laboratory studies and, in order to achieve

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complete and accurate description, it is essential that the educational scientist be both capable and willing to extend the investigation beyond the confines of the laboratory to the events that occur in the field--to the events that take place in typical instructional settings--to the spaces in between. He must discover, evaluate, and articulate those points at which the laboratory findings interact with the critical elements of the natural educational setting. The value of the investigator's efforts to maximize the internal validity of experiments by carefully controlling variables cannot be denied, but the educational scientist must be equally aware of the necessity to preserve the external validity of research studies as well (Campbell and Stanley, 1963). In this regard, L. S. Shulman (1970) has noted that all too often behavioral science researchers in education have been prone to ignore questions of external validity and consequently have tended to overgeneralize laboratory findings to the classroom, a setting that differs in many ways from the one in which the research was conducted.

#### General Purpose of the Study

The general purpose of this investigation was to explore the instructional effectiveness of a two-person interaction system as it functioned within a natural educational environment. In essence, this project involved

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the design, implementation, and evaluation of a peer-based teaching strategy that appeared to be capable of alleviating certain instructional problems that were present in an introductory course in teacher education.

### A Problem in a Natural Educational Setting

The course of interest was titled The Individual and the School and was offered to beginning students in teacher education at Michigan State University. The course provided two main types of educational experiences for students. The first, the Interpersonal Process Laboratory (IPL), was a small group activity that was designed to (1) develop the student's inter-personal communication skills, (2) help the student examine his or her system of values and beliefs, and (3) teach the student how to apply the Teaching Process Model, a modification of the "Basic Teaching Model" originally developed by Glaser (1962), to the interpersonal aspects of instruction. The second type of educational experience employed films, slide-tapes, individual tutors, and written materials for in-depth individualized study of the Teaching Process Model and its major components--assessment, goal setting, strategy selection, and evaluation. This latter phase of the course provided the natural educational setting in which this study was conducted.

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Although the conceptual framework for both phases of the course was the Teaching Process Model, the two instructional experiences tended to examine it from slightly different perspectives. The Interpersonal Process Laboratory utilized the model to facilitate individual self-growth in order to prepare the future teacher for "The Personal Demands of Teaching," i.e., the interpersonal encounters and communications that occur between teacher and student. The auto-instructional program, in contrast, emphasized the use of the teaching process model for "The Task Demands of Teaching," i.e., the planning of instruction in order to facilitate the growth of others. Both the Interpersonal Process Laboratory and the auto-instructional program employed a mastery learning approach (Bloom, 1968). A student was required to attain a prespecified level of performance on the objectives for each phase in order to receive credit for the course.

The overall course consistently received high ratings from students each term, but the Interpersonal Process Laboratory was generally perceived more favorably than was the auto-instructional program. For example, data collected during Winter and Spring Terms of 1972 (Stiggins, Byers, and Shwedel, 1972) indicated that a large percentage of students viewed the Interpersonal Process Laboratory as being that phase of the course which contributed most to their thinking about education.

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Similar reports for the Fall, Winter, and Spring Terms of the 1972-1973 academic year (Urban and Byers, 1973; Urban, 1973a, 1973b) also showed that a large percentage of students perceived the Interpersonal Process Laboratory as being the most interesting phase of the course.

These findings indicated relatively different student perceptions and attitudes toward these two parts of the course, but offered little explanation for the differences. However, another report (Shwedel, Stiggins, and Byers, 1972) contained a complete listing of student recommendations for improving the course and, although the comments were only collected during Winter Term of 1972, they did suggest several possible reasons for the relative dissatisfaction with the auto-instructional experience. A few of the general comments were as follows: there were too few reinstructors (individual tutors) available during periods of peak activity; there was too much pressure to complete the modules; reinstructors often seemed to be too objective and pressured; the concepts could be made more relevant by applying them to personal experiences; there was a need for more stimulation and motivation to do the modules; content should be taught in the small groups (IPL); there was a lack of continuity between the carrels and the IPL, e.g., the carrels were very private, whereas the IPL groups were very open; more discussion of carrel concepts was needed;

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and more opportunities for feedback should be provided. This set of comments was selective, but it was representative of those that students had wished to make about the instructional program.

Although they pointed out the need for specific instructional activities, e.g., more feedback and discussion, the comments also generally suggested a need for more personal interaction within the auto-instructional phase of the course. The program did utilize individual tutors for reinstruction, but the comments indicated that there was at least some dissatisfaction with their effectiveness--dissatisfaction that appeared to be related to the constraints under which the individual tutors worked, rather than dissatisfaction with the tutors as individuals. The comments also suggested that the opportunities for openness and interaction that characterized the Interpersonal Process Laboratory were less available in the other phase of the course.

In general, the comments seemed to provide a specific illustration of Mallinson's (1969) position concerning the general neglect of personal interaction systems in education. Yet, it was neither feasible nor advisable to abandon the auto-instructional program in favor of the Interpersonal Process Laboratory. Each phase of the course had certain objectives that could best be attained through particular instructional

strategies. to be well suited learning objectives that this can most programs tionably complete State University a document which for enhancing courses. However of a greater degree result in even improve student phase of the course

#### A Model

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strategies. The individualized study program appeared to be well suited for teaching the cognitive-oriented learning objectives that it employed, and it was likely that this carrel program was as good as, or better than, most programs of a related nature; this program unquestionably complied with every provision of the Michigan State University Code of Teaching Responsibility (1969), a document which establishes rather specific guidelines for enhancing the quality of instruction in university courses. However, it was anticipated that the addition of a greater degree of interpersonal interaction could result in even more effective learning and could also improve student attitudes toward the auto-instructional phase of the course.

#### A Mutual Two Person Interaction System

Mallinson's (1969) observation that education is frequently viewed as a unidirectional transaction that proceeds from teacher to student warrants serious consideration. Certainly, there have been important theoretical and research contributions related to the role played by interpersonal interactions in education. For example, in 1960 the National Society for the Study of Education devoted Part II of its yearbook to the dynamics of instructional groups. Concern for the sociopsychological aspects of teaching and learning has continued,

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one of the most recent works being Bidwell's (1973) informative discussion of "The Social Psychology of Teaching."

For the most part, interest has tended to focus on the interactions that occur between a person who formally occupies the role of teacher and another person who formally occupies the role of student. For example, Bidwell (1973) centers his attention on the personal influence that the teacher brings to the teacher-student dyad. Flanders' (1964) work, although it argues for the expansion of student freedom to participate in learning endeavors, also tends to focus upon teacher influences in classroom interactions.

However, as Mallinson (1969) has suggested, the process of acquiring knowledge and skills need not proceed only from a teacher to a student; learning can be a joint effort pursued by two or more persons interacting together with a particular subject. The following statement by Bruner (1968) supports Mallinson's position:

The corpus of learning, using the word now as synonymous with knowledge, is reciprocal. A culture in its very nature is a set of values, skills, and ways of life that no one member of the society masters. Knowledge in this sense is like a rope, each strand of which extends no more than a few inches along its length, all being intertwined to give a solidity to the whole. The conduct of our educational system has been curiously blind to this interdependent nature of knowledge. We have "teachers" and "pupils," "experts" and "laymen." But the community of learning is somehow overlooked. (p. 126)

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A promising instructional strategy that appeared to answer Mallinson's (1969) plea for mutual two or more person interaction systems in education is the learning cell. Goldschmid (1971) has claimed that, given a certain amount of structure and organization, two people working together on an academic task, i.e., working in a learning cell, can produce highly effective learning for both participants. In the learning cell, members mutually teach and learn from each other, a procedure that, in some ways, appears to build upon the need to reciprocate-- "to respond to others and to operate jointly with them toward an objective." (Bruner, 1968, p. 125.)

#### Anticipated Advantages of a Learning Cell Approach

Given its great promise as an instructional approach, a learning cell strategy was designed, implemented, and evaluated as an alternative, on a trial basis, to the standard auto-instructional procedures that were in operation within The Individual and the School. It was anticipated that such an approach, in the form of the learning cell, would contribute to the quality of the course in the following ways: (1) provide important conditions for effective learning, (2) alleviate administrative difficulties within the course, and (3) improve student attitudes about the course.

Conditions for  
Effective Learning

One important condition is the opportunity to learn. Extrinsic rewards can, and frequently do, motivate, but, ever, intrinsic rewards are also potent reinforcements of the human need to learn. The learning process is an individual characteristic, and effectiveness of learning depends on operations, techniques, and materials. When these conditions are met, roles that teachers play are important. This appears to be true together in the classroom (1968, 1972) team teaching is also becoming more common.

Maguire (1968) has shown that motivation is not only a function of apparent reinforcement, but also of the presence of a great deal of reinforcement.

### Conditions for Effective Learning

One important factor in an instructional situation is the degree to which the individual is motivated to learn. External rewards such as credits or grades can, and frequently do, motivate student learning. However, intrinsic motives for learning (Bruner, 1968) are also potent resources and one intrinsic motive, the deep human need to reciprocate, appeared to function within the learning cell. Bruner has suggested that if the individual can see how he or she contributes to the effectiveness of the group's, or in this case, the dyad's, operations, that individual is likely to be more activated. When these operations are of a learning nature, one of the roles that typically emerges is that of auxiliary teacher. This appears to be what happens when two individuals work together in a learning cell--each partner becomes an auxiliary teacher, and a community of learning (Bruner, 1968, 1972) is established. Partners not only become team teachers in a unique, non-traditional sense, they also become team learners.

Mager (1961) has suggested that a learner's motivation increases as a function of the amount of control, or apparent control, that he has over the learning experience. This is probably due to the fact that the learner has a greater sense of participation and a personal

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investment in the outcome. In the learning cell, participants appeared to have the potential to exert a relatively large amount of control over their learning. Members could share their ideas on structuring their learning experiences, influence each other in ordering the priorities for study, and reinforce one another if these mutual decisions deviate somewhat from the standard course expectations (L. Shulman, 1970).

The chance to participate in a learning cell seemed to offer the teacher-trainee an opportunity to engage in the process of teaching as early as his or her first course in education, thus making the learning experience seem more relevant and important to his or her ultimate, but relatively distant, professional goal--being a teacher.

These three sources of motivation, the need to reciprocate, the ability to exert a relatively large amount of control over one's learning experiences, and the opportunity to engage in a task that appeared to be personally relevant, were all expected to operate within the learning cell.

Learners could easily alternate between the teacher and student roles in the learning cell. This dual-role activity was expected to be of particular value to teacher-trainees as it provided an excellent opportunity to view oneself from two perspectives--as a

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student trying to communicate learning needs to another, and as a teacher trying to understand what the student's learning difficulties were and how they could be alleviated. Since they would be able to practice the teaching role, although on a relatively low level, it was anticipated that learning cell participants would tend to report more complete understanding of teaching concepts and would find the course to be more relevant to teaching than would non-participants.

Although the ability to assume these two perspectives, i.e., that of teacher and that of student, appeared to be important for effective teaching, the viewing of subject matter from more than one perspective was also expected to enhance the quality of learning in other ways. For example, Moore and Anderson (1969) maintain that "One environment is more conducive to learning than another if it both permits and facilitates the taking of more perspectives toward whatever is to be learned" (p. 585). In conventional learning situations, learners tended to approach a subject from the perspective of a student; however, in the learning cell other perspectives, such as that of the teacher, were available as well. The old saying "If you want to learn something, teach it" appears to be based upon the same principle. Johnson (1972) has rephrased the saying into a hypothesis: ". . . learning is more efficient when the learner puts the relevant

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(p. 313).

In addition, the learning cell seemed to provide important opportunities for active learner practice and feedback. Since each learner would bring a different set of experiences, goals, attitudes, and knowledge to the learning encounter, important course material was likely to be considered and practiced in a variety of contexts. Similarly, the dynamics of the learning cell tended to prevent the learner from merely absorbing material; the learner had to demonstrate a knowledge of that material to another--his or her partner. Thus, a kind of overt rehearsal was built into the system. Feedback was expected to be relevant, timely, frequent, and likely to be presented on a cognitive level more closely related to that of the student. Since learning could be monitored continuously by one member of the cell, on-the-spot correction of errors was possible, and thus, more effective learning could occur.

Since it was believed that the course subject matter would be considered from several perspectives and appropriate practice and feedback would occur, learning cell members were expected to achieve higher scores on

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the Unit Mastery Evaluations than were non-participants. In addition, it was anticipated that learning cell members, as compared to non-learning cell members, would tend to report that they had considered the course material in a variety of contexts since each member would be likely to provide different examples for consideration during joint study sessions.

#### Alleviation of Course Administrative Difficulties

It was anticipated that learning cell members, by carefully monitoring their partner's learning, would help to reduce the number of inadequately prepared test-takers and therefore reduce the amount of reinstruction required. Since dyad members would work together on various content modules, it was also anticipated that there would be a certain amount of peer pressure to maintain a relatively evenly paced schedule of study rather than one that left studying until late in the term.

#### Improvement of Student Perceptions of the Course

Since the learning cell appeared to incorporate so many principles of effective learning, it was anticipated that learning cell participants would find their learning experiences to be more positive than would non-participants and thus, they would more highly rate various

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components of the auto-instructional phase of the course. In addition, it was expected that the introduction of the learning cell option into the auto-instructional phase of the course would provide an opportunity for partners to practice the communication skills which they had studied in the Interpersonal Process Laboratory. It was thus anticipated that learning cell subjects would report that there was more integration of the two phases of The Individual and the School course than would students pursuing the standard course procedures.

#### Rationale for the Study

One of the reasons for conducting the study was the need to investigate how well a learning cell strategy could alleviate some of the instructional problems which were present in the auto-instructional phase of The Individual and the School course. However, there were several additional ways in which this study was expected to make useful contributions: (1) extend research on the learning cell into the field of teacher education; (2) examine the effectiveness of the learning cell in a course which employs the mastery learning model; and (3) investigate the effect of structure on learning cell performance.

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### Teacher Education

Teacher education is a subject where the potential contributions of the learning cell approach may be greater than in most fields of study, and yet, no research on its use in this area has been reported. The teacher-trainee who participates in a learning cell has the opportunity to actually practice using the subject matter he or she studies, i.e., the process of teaching. In the learning cell teaching can be both a subject and a mode of study.

### Mastery Learning

The learning cell approach has been almost completely employed in classroom settings that have imposed time limitations for interaction on a particular subject of interest (e.g., Goldschmid, 1971; Schermerhorn, 1971). The present study sought to examine the effectiveness of the learning cell in an educational context that left participants a relatively large amount of freedom to determine when, where, and for how long they would study course material. In addition, this study considered the effectiveness of the learning cell in respect to the level of complexity involved in the cognitive tasks performed by the learners.

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## Structure

A related consideration in the utilization of peer-instructional strategies is the degree of structure that must be supplied in order for the program to operate effectively. Goldschmid (1971) has maintained that a sound structure and proper management are necessary in order to create an optimal learning environment. However, the questions of how much and what kind of structure is needed in a particular learning situation have not been clearly resolved. At present, there are few conclusive studies concerning the relative effectiveness of learner-controlled versus instructor-controlled learning (Alexander, et al., submitted for publication).

## Overview of the Study

The primary objective of this study was to design, implement, and evaluate a peer-based instructional strategy involving pairs of learners working together in an ongoing, mastery-based, introductory level teacher education course. This peer-based instructional strategy, the learning cell, was defined as a unit in which learners mutually teach and mutually learn from each other.

The original design involved two learning cell treatments, structured and unstructured, and a control treatment. However, a heavy loss of experimental subjects required modifications in the design such that

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viable and nonviable learning cells comprised the experimental treatment groups. Viable learning cell subjects were compared with nonviable learning cell subjects in 12 experimental hypotheses concerning the potential of the learning cell to (1) provide important conditions for effective learning, (2) alleviate administrative difficulties, and (3) improve student perceptions of the course.

Learning cell characteristics and processes were also examined, primarily through interviews and reports of learning cell meetings by participants. Results of this examination were reported in the form of two case studies and summary statements of a descriptive nature.

In addition to Chapter I, Introduction, this report is organized as follows: Chapter II, Review of Research Literature; Chapter III, Method; Chapter IV, Results; and Chapter V, Summary and Conclusions.

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## CHAPTER II

### REVIEW OF RESEARCH LITERATURE

The purpose of this chapter is to examine research literature relevant to the learning cell. The following topics are considered: (1) the learning cell; (2) peer instruction; (3) applicability of peer instruction systems; (4) dyad-controlled versus instructor-controlled activities; and (5) research strategies.

#### The Learning Cell

The learning cell is a dyadic unit in which partners mutually teach and mutually learn from each other (Alexander, Gur, Gur, and Patterson, submitted for publication). Thiagarajan (1973) maintains that the technique of learners teaching each other goes at least as far back as the first century to Quintilian. Bell's Mutual Tuition and Moral Discipline (1832) discussed peer instruction in some detail, but the true learning cell approach appears to be of more recent parentage. Goldschmid (1971) refers to the learning cell as an educational innovation and suggests that it is derived from the work of Kingsbury (1968) on the dyad method of

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instruction. Kingsbury had begun experimenting with this method as an alternative to the standard university lecture. Kingsbury was searching for an instructional strategy that would (1) maximize learning, and minimize student and staff effort as well as financial cost, and (2) create an environment where resourcefulness and self-motivation would be fostered in students. The result of Kingsbury's efforts was a mutual teaching-learning strategy based on the smallest possible unit of interpersonal interaction, the dyad. Kingsbury employed dyadic learning in a number of university level courses and found that it led to productive learning encounters when participants were taught important communication skills and received proper guidance from a consultant.

Goldschmid (1970, 1971) developed two procedural options that more clearly defined the nature of the learning cell strategy. One general procedure, Option A, was designed to be an arrangement in which class members read the same assignment on their own and prepared teaching questions on the material according to guidelines provided by the instructor. At the beginning of class, student questions were checked by the instructor, and then students were paired, either by the instructor or the students themselves. Students then took turns asking their questions; the general sequence was the following: the first dyad member asked a question on the

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subject matter, the other member responded, then the first dyad member corrected or elaborated on the answer. After the first question had been mutually resolved, roles were reversed and the other partner asked his question. As this process continued, the instructor moved from dyad to dyad giving feedback, asking and answering questions, and evaluating student performances. Goldschmid has maintained that the objective of Option A is to create an intensive dialogue between students which checks on and deepens the understanding of the material, and in addition, provides an opportunity to exchange other ideas and information relevant to the particular topic.

In contrast, Option B was designed for use in a situation where dyad members had worked on different assignments; for example, when a reading list was so long that each member would have difficulty covering everything on his own. The typical sequence of activities in this arrangement was the following: during the first half of a classroom period, one dyad member would describe and explain the major points that he had encountered in his reading to the other member of the dyad, then the first member would check the other's understanding through appropriate questions, making corrections and modifications when needed. Partners reversed roles halfway through the class period. Goldschmid recommended

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Option B for classroom situations in which the objective was to learn new knowledge; Option A was recommended for situations in which it was necessary to review material already studied.

Goldschmid's (1970) first study compared seminar, discussion, independent study, and learning cell study options as they were employed in a university psychology course. Results indicated that students in learning cells performed significantly better on an unannounced essay examination and a comprehensive course evaluation. In addition, learning cell students consistently reported higher subjective ratings of overall satisfaction for each class hour than did students in the other three study options.

Goldschmid (1971) has suggested that the learning cell approach, at least a priori, appears to lend itself to any academic discipline or educational level. In a recent investigation Goldschmid and Shore (1974) have found evidence to demonstrate the effectiveness of the learning cell in a variety of university courses such as educational statistics, management, German, educational psychology, law, and chemical engineering. These field studies revealed no apparent restrictions on the implementation of learning cells in respect to class size, level of instruction, nature of the subject matter, or general student characteristics. It was recommended, however,

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that the learning cell be employed on an occasional basis rather than at every class meeting. The investigators also concluded that several learning cell variations were feasible; e.g., learner-prepared questions could be based upon films, tapes, or guided laboratory exercises, as well as textual material, and pairs could work together productively outside of regular class-meeting times. It was also noted that both learners and instructors quickly became more proficient in running the learning cell as they continued to work with it.

Schermerhorn (1971) investigated the effectiveness of the learning cell for the acquisition of principles of probability by fifth grade, ninth grade, and university students. Subjects read about probability and then prepared study questions which were discussed with partners during two class periods. Objective test scores improved significantly after reading, and again after learning cell discussions. Schermerhorn concluded that, when working in pairs, children as young as ten years of age are capable of learning basic probability principles with no assistance from the teacher, except for the initial choice of instructional materials.

Recently, Alexander, et al. (submitted for publication) conducted a series of experimental studies on a number of variables that appeared to influence the effectiveness of learning cells. In the first experiment,

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the effects of individual versus dyadic learning, and structured versus unstructured learning procedures were assessed. The subject matter was mathematical word problems and Alexander, et al. noted that these problems required the learner to organize and interpret facts and apply principles. The task involved analysis and synthesis, two of the more complex cognitive skills in Bloom's taxonomy of behavioral objectives (Bloom, 1956). Results indicated that learning cell members learned how to solve the mathematical word problems significantly better than did individual learners. The effects of the structure variable, i.e., the degree to which learning activities were specified and controlled by the experimenters or the learners, were not statistically significant. On a questionnaire given at the conclusion of the experiment, all experimental groups except the unstructured learning cell expressed generally negative attitudes toward the experiment, although, once again, the differences among groups were not statistically significant.

Alexander, et al. designed a second study which involved pairing students according to three characteristics: academic competency, sex, and previous experience. The proposed study failed to materialize because learners absolutely refused to work in pairs with a partner whom they did not know and who had been assigned to them by a computer.

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The experiences encountered in these first two studies indicated that learners disliked being assigned to partners in an arbitrary fashion and they also tended to object to the imposition of a structured method of studying together. Therefore, in the design of a third study, Alexander, et al. decided to investigate the interaction dynamics of learners studying together in "natural" learning cells, i.e., those in which learners had been studying together on their own initiative. Eighteen natural learning cells were identified from a pool of respondents to a campus newspaper advertisement. Each natural dyad was interviewed. Interviews primarily concentrated on learning cell processes and included the following topics: competence commonality of partners; background variability of partners; motivational levels; interpersonal relations; study procedures; decision making and conflict resolution; quality of learning; test anxiety; and alienation.

The results suggested that learners were able to study and learn together successfully without one partner being more knowledgeable or skilled than the other; i.e., partners could, in fact, mutually teach and mutually learn in a learning cell. Several learners emphasized that they continued to participate in their learning cell because they felt that both partners made valuable contributions and both seemed to benefit from their

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In general, the natural approach of Alexander, et al. for the study of learning cell processes appeared to be a much more productive strategy than those pursued in the previous two experiments. The interview technique enabled the investigators to examine a wide range of variables and provided enough information to produce several generalizations about how dyad members effectively study together.

In summary, the investigations of Kingsbury (1968), Goldschmid (1971), Schermerhorn (1971) and Alexander, et al. (submitted for publication) demonstrated the potential effectiveness of the learning cell approach for instruction. These studies suggested that consideration should be given to the ways in which the learning cell is structured and the ways in which learning cell research might best be conducted. In addition, these studies emphasized the importance of mutual learning-teaching interactions. Kingsbury noted the effects of learning cells in a number of subject areas and Alexander, et al. suggested that the cognitive complexity of the subject matter was an important consideration.

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### Peer Instruction

The learning cell is a peer-instructional strategy based upon a mutual learning-teaching relationship between two people. Peer-instructional procedures do not always incorporate this reciprocal relationship, and often the degree of teaching involved is minimal. The following descriptions of research studies illustrate the general nature of peer instruction, yet also point out critical features of the learning cell.

Torrance (1971) found that college students who took a test of creative thinking in dyads attained a higher level of originality and experienced stronger feelings of enjoyment, stimulation, and originality of expression than students who worked individually under standard test conditions. Rosenbaum (1973) reported success with a program of "peer-mediated instruction," a structured format for interaction in which one dyad member provided immediate selective correction of errors and differential work assignments for the other dyad member by referring to a printed guidebook that contained the appropriate answers and activities.

However, Myers, Travers and Sanford (1965), in a study of teacher-pupil roles employed in a feedback system for learning 60 pairs of German-English word pairs, found that subjects assigned to the teacher role only in a learning dyad performed less well on tests of immediate

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and delayed retention than did subjects who were assigned to pupil roles only, teacher-pupil roles, and self-instruction roles. Although subjects in the pupil role only condition showed significantly superior learning to all other conditions, Myers, Travers and Sanford reported that both members of a dyad in the teacher-pupil role condition learned to about the same degree and tended to remain highly interested and attentive throughout the learning task. In contrast, the experimenters suggested that one of the problems with auto-instructional programs was that they frequently offer little variety in experiences and their impact on learning may decrease substantially with continued use. The experimenters stressed the importance of peer feedback in the learning task and they pointed out the need to examine the learning effects of reversing teacher-pupil roles more frequently than only once midway through a task as they had done.

Sheppard and MacDermot (1970) investigated a peer instructional program similar to one developed by Ferster (1968) in which the experimental subjects took part in an interview procedure. A student participated in an interview as a "speaker" after he had studied a small section of the text. The "listener" in the interview was usually another student who had previously studied for and successfully passed an interview on the material. The speaker was required to describe the material in detail and, upon

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completion of this description, the listener was responsible for asking questions on omissions or inaccuracies, commenting on the speaker's performance, and engaging the speaker in discussion of the content. Both speaker and listener had joint responsibility for determining if the speaker had attained mastery of the section. When the speaker failed to reach mastery, he restudied the same material and then repeated the interview. Each student in the experimental group was required to serve alternatively as a speaker and a listener for a designated number of times during the course.

Results of the study indicated that students in the experimental group scored significantly higher on objective and essay final examinations and tended to rate the course more positively than students who were taught the same subject matter in a more conventional manner, primarily small group discussion. There was a 17% drop rate for the course for those learners who participated in the experimental teaching procedure. Those students who dropped the course seemed to feel that the course was too difficult and involved too much work.

Weingarten, Hungerland, Brennan, and Allred (1970) developed the APSTRAT peer instructional model for use in military training. The model includes the following sequence of training for the learner: observing a peer performing the task; learning the task from this same peer;

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performing the task; and teaching the task to a new trainee. MADRAS (Mutual Achievement through Didactic Role Alternation Strategy) which was developed by Thiagarajan (1973) is similar to the APSTRAT system, except that the peer not only learns and teaches the subject matter, but also tests learners on their understanding of it, a feature that is also found in the Sheppard and MacDermot (1970) system as well as those of Ferster (1968), Keller (1968), and Hapkiewicz (1972). Both Weingarten, et al. and Thiagarajan have reported successful use of their approaches although they have presented no data in support of their claims.

#### Active Learning and Teaching

The instructional strategies which were employed by Myers, et al. (1965) and Rosenbaum (1973) involved peers in teacher-type roles. However, in each case, the teaching peer only performed low-level kinds of instruction. There was little need for the peer in the teacher role to actively review, organize, and reformulate the material in order to present it to his partner. In the peer-mediated instructional system of Rosenbaum, a dyad member merely needed to refer to the correct answer in the structured materials that were provided. The answers to the German-English word pairs were also made available to the peer teacher in the Myers, et al. study.

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In contrast, the procedures of Kingsbury (1968), Goldschmid (1970), Sheppard and MacDermot (1970), Weingarten, et al. (1970), Schermerhorn (1971), Thiagarajan (1973), and Alexander, et al. (submitted for publication) all required peers to engage in active learning of the material.

The learning cell permits an individual to approach a subject from the student and teacher perspectives and this seems to be an extremely effective way of learning. Moore and Anderson (1969) have maintained that one educational environment is more conducive to learning than another if it facilitates the taking of more perspectives toward the subject. Similarly, Rosenbaum (1973) has suggested that the apparent potency of peer-mediated instruction is based on the fact that participation in two roles, student and teacher, encourages a multi-mode encounter of the subject matter with an intensity that is difficult to achieve under conventional classroom conditions. Thelen (1968, 1969) has emphasized that this same effect occurs in the tutorial; the tutor seems to benefit by achieving a deeper understanding of the material in preparation for teaching the tutee. Bruner (1972) has emphasized the learning value of teaching as well:

It has long been obvious that children learn from their peers, but a more significant observation is that children learn from teaching other

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children. From this a major educational strategy follows: namely, that every child must be given the opportunity to play the teaching role, because it is through playing this role that he may really learn how to learn.... The concept of learning through teaching appears to be one of those basic ideas which do work, and it is finding a place in an enormous variety of settings...where the entire school is directed toward becoming a "tutorial community." (p. 62)

Gagné and Rohwer (1969) have expressed some skepticism about the value of learning by teaching. Long (1971), however, has presented data to the contrary. In a paired-associate experiment, it was found that serving as an experimenter, a role similar to that of a teacher, facilitated subsequent learning of paired-associates. Long suggested that the beneficial effects of teaching may not necessarily be the acquisition of the material being taught, but rather in the learning of subsequent material. The individual who serves as teacher may be, in fact, learning about the complexities of the stimulus environment, and thus, in effect, may be learning how to attend to that particular subject matter.

In contrast, Bright (1972) has suggested that one of the benefits of teaching is that it creates the necessity for precision, judgment, and reliability. In support of this thesis, Zajonc (1960) found that students who were told to learn material for later transmission to another person differentiated the information better than did students who were told that they were merely to keep the information in mind. Bruner (1965)

has suggested that such an active attitude leads to a transformation related to the task later to be performed.

Moore and Anderson (1969) have also argued that one educational environment is more conducive to learning than another if the subject matter encountered within it is more productive. More productive domains of knowledge support "generic learning"; i.e., they have a structure that allows the learner to understand the subject in a way that permits other things to be related to it meaningfully (Bruner, 1959, 1960, 1968, 1971). This suggests the need to consider the properties of the content that is studied in learning cells. Subjects that are based on a set of propositions that permit learners to actively generate a larger body of knowledge seem to be particularly amenable to study in learning cells. In contrast, less productive subjects, e.g., those that involve rote memory types of learning, may fare less well in learning cells.

### Mutual Learning and Teaching

With the exception of the instructional arrangements employed by Myers, et al. (1965) and Rosenbaum (1973), each of the procedures reviewed so far has involved a relatively large degree of learning and teaching by peers. However, there is another characteristic of learning cell operations that is essential, i.e., the

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mutual, relatively simultaneous encounter of the subject matter by learners working together to understand the material.

The procedures employed by Kingsbury (1968), Goldschmid (1970), Schermerhorn (1971), and Alexander, et al. (submitted for publication) all involved mutual teaching and learning by dyads. However, many other strategies (Ferster, 1968; Sheppard and MacDermot, 1970; Weingarten, et al., 1970; Hapkiewicz, 1972; Tiagarajan, 1973) involved peers who had learned the material prior to teaching and testing partners. These strategies made no formal provisions for insuring that both teacher and student roles were experienced by both members during a particular learning encounter.

The value of cooperative activity is reflected in the following statement by Piaget (1964):

...doing things in social collaboration, in a group effort. This leads to a critical frame of mind, where children [learners] must communicate with each other. This is an essential factor in intellectual development. Cooperation is indeed co-operation. (Quoted by Duckworth, 1964, p. 174.)

Bruner (1968) suggests that an important intrinsic motive based upon a deep human need to respond to others and work jointly with them in reaching a goal is reciprocity. He notes that the motive to reciprocate can be a powerful driving force to learn when an individual is placed in a situation where a particular corpus of

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knowledge is required by the group in order to achieve its objectives. The need for joint action seems to intensify the will to learn. According to Bruner, reciprocity is most likely to flourish in educational settings where there are opportunities for discussion and interaction. In such reciprocally operative contexts, specialized roles can develop and a community of learning may be established. Bruner suggests that one role that will surely emerge in these groups is that of the auxiliary teacher.

One of the key dynamics in the learning cell is that dyad members mutually teach and mutually learn from each other. A kind of symmetrical dyadic contract (Foster, 1961) is established in which comparable knowledge and skills are exchanged between individuals at relatively equal learning states. In contrast, the tutorial is based upon an asymmetrical dyadic contract in which different things are exchanged between people with relatively different learning states. Although the educational benefits that accrue to the tutor through tutoring have been well documented in recent years, e.g., Thelen (1969), the tutor usually enters the tutoring situation with the expectation of receiving "goods" in the form of money, academic credit, ego satisfaction, et cetera, whereas the tutee typically expects to receive knowledge or skills in the exchange.



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Sahlins (1965) suggests that the social relationship can vary on a continuum that ranges from "generalized reciprocity," where a person gives assistance and, if possible or necessary, will receive assistance in return, to "negative reciprocity," in which a person takes without giving. Sahlins refers to direct exchange as "balanced reciprocity."

It seems likely that the success or failure of a learning cell may be dependent on the nature of the intellectual transaction that occurs between partners. Both members of the dyad undoubtedly make assessments as to the value and appropriateness of their partner's contribution to the learning situation and it seems reasonable to assume that if one member perceives the other as a "negative reciprocator," it will tend to threaten the effectiveness of the learning environment. In contrast, the successful operation of a learning cell may be dependent on mutual perceptions that either "balanced reciprocity" or "generalized reciprocity" is present. Bruner (1968) has suggested that the learner also must see his or her own contribution as being of value to the group; an assessment is made of oneself as well as of one's partner.

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### Applicability of Peer Instruction Systems

Taylor (1969) has argued that peer instruction should be a vital part of the college curriculum. The studies of Kingsbury (1968), Goldschmid (1970), Sheppard and MacDermot (1970), Schermerhorn (1971), and Alexander, et al. (submitted for publication) support Taylor's argument. However, peer instructional strategies also have been proven effective across many subject matter areas and at various levels of instruction. Rosenbaum (1973) successfully employed peer-mediated instruction in elementary school spelling, secondary school reading, and industrial training. Weingarten, et al. (1970) used peer instruction for military basic training programs. Sheppard and MacDermot (1970) used peer instruction in an introductory psychology course. Kingsbury's (1968) work explored the usefulness of the learning cell in such academic disciplines as chemistry, English, psychology, communication, sociology, and philosophy. One study by Goldschmid (1970) involved students in a psychology course. In a more recent investigation, Goldschmid and Shore (1974) found that the learning cell could be appropriately applied in such university level courses as educational statistics, management, German, educational psychology, law, and chemical engineering. One of the studies by Alexander, et al. (submitted for publication) involved a

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mathematical problem solving task; a further study indicated that natural learning cells studied a variety of subjects together even though both members frequently had different college majors, e.g., engineering/communication, biology/criminal justice, English/sociology, chemistry/humanities.

Yet, even though peer dyad learning procedures have been successfully used in a wide range of subject matter areas there is no evidence that they have been previously employed in teacher education courses.

#### Dyad-Selected Versus Instructor-Selected Activities

Kingsbury (1968), Goldschmid (1971), and Alexander, et al. (submitted for publication) have emphasized the need for a course instructor to insure that learning cell activities are soundly structured and properly managed. However, one of the Alexander, et al. studies indicated that learners objected to the imposition of a structured method of studying together.

Mager (1961) has reported research to suggest that adult learners who have been provided with behaviorally stated objectives, and have also been given control over their learning, will attain the objectives by dovetailing what they need to know with what they already know. Mager and Clark (1963) have noted that adult learners frequently enter a learning situation with a

significant amount of relevant knowledge and that often these learners are as likely to be overprepared for the unit of instruction as they are likely to be underprepared. In some instances the adult learner may be an excellent judge of what needs to be learned in order to achieve a certain set of objectives.

L. Shulman (1970) has made observations similar to those of Mager. For example, Shulman has noted that peers can share ideas on structuring learning experiences and, although the instructor may provide some guidance, it is the students who have the clearest perspective of where they are at any given moment.

Questions of how much and what kind of structure should be provided for learning cell activities have not been resolved. Arguments in favor of and against learner-controlled instruction can be found in the research literature.

#### Research Strategies for the Study of Learning Cells

The majority of research investigations of the learning cell have been conducted in natural educational settings (Kingsbury, 1968; Goldschmid, 1970, 1974; Schermerhorn, 1971; Alexander, et al., submitted for publication).

One of the strengths of field experiments is their appropriateness for studying complex social

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influences and processes. They have been particularly fruitful strategies for investigating the dynamics and interactions of small groups. Kerlinger (1973) has noted that the field experiment is quite flexible and well suited both to the testing of theory and the solution of practical problems, both of which were objectives of the present investigation. The field experiment permits the researcher to make statistical inferences, yet also examine certain important processes in greater detail when it is necessary. It permits the investigator to reap the benefits of "intensive designs" (Thoresen, 1972) as well as "group designs." In the initial stages of the development of an applied strategy like the learning cell, intensive designs can supply the investigator with a number of potentially valuable hypotheses for further study.

### Summary

The review of the literature on the learning cell indicated that, although it had not been subjected to extensive study, it was a promising instructional strategy. The learning cell was defined and compared with other peer instructional systems in terms of two attributes: (1) active learning and teaching; and (2) mutual learning and teaching. Previous applications of the learning cell were discussed with respect to subject matter,

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class level, and course organization. The issue of dyad-controlled versus instruction-controlled learning cells was raised and the field approach to research on the learning cell was examined.

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## CHAPTER III

### METHOD

The design, implementation, and evaluation of the instructional methods employed in this study involved a number of procedures. This chapter describes the procedures and their organization. The following topics are considered: (1) population and sample; (2) materials and facilities; (3) measures; (4) design; (5) research questions and testable hypotheses; and (6) analyses.

#### Population and Sample

Students who were enrolled for the first time in The Individual and the School course at Michigan State University during Spring Term, 1974, comprised the population for this study.

A sample of 150 subjects was selected from a population of 511 students. Those students who had received "incomplete" grades from prior terms were excluded from the experimental population. It was necessary to select a relatively small sample since large numbers of subjects were expected to create administrative problems for carrel room personnel. For example, even though much learning

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cell activity was expected to occur outside of the carrel room, student pairs might also have wished to work together in the carrels, an activity that would have disrupted the normal routine of the course if there was participation by a large number of learners.

Three treatments were involved in the original design: (1) structured learning cell procedure; (2) unstructured learning cell procedure; and (3) control procedure. The latter treatment involved individual learners who pursued the standard auto-instructional options. Since two of these treatments involved dyads and the remaining treatment only involved individuals, the sampling plan was rather complex. In addition, there were several potential problems that needed to be taken into consideration.

The first problem was one that Alexander, et al. (submitted for publication) encountered when they attempted to pair students with different characteristics. Alexander, et al. reported that the experiment failed because the students absolutely refused to work with a partner whom they did not know and who had been assigned to them by a computer. This result prompted Alexander, et al. to locate and investigate natural student-initiated learning cells; the results of this latter study indicated that students in these natural pairs emphatically reported that mutual liking and understanding, along with smooth



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interpersonal relationships, were vital factors in the success of their learning cells. Thus, one of the primary considerations in the design of this investigation was that dyad members did, in fact, know one another and want to work together.

A second related problem concerned the potential effects of using a mastery learning model for "The Task Demands of Teaching" phase of the course. In the usual auto-instructional procedure, students paced themselves in their study of various units. However, activities in the learning cell treatments were normally dyad-paced, not self-paced. Both partners were required to maintain similar schedules for study of the particular modules. This procedure could be viewed as one of the important advantages of the learning cell strategy, but it was also expected to be a source of problems if one member tended to slow down his partner's completion of various unit modules. Under these circumstances, a partner could become quite anxious about finishing the course on time, a situation which could easily affect the quality of the peer relationship, and possibly bring about dissolution of the learning cell. Thus, it appeared to be important to give experimental subjects an opportunity to select a partner whom they saw as being capable of maintaining a similar study pace.

Given these two potential problems, it was critical

that a sampling and assignment procedure be designed that would eliminate as much experimental reactivity (Campbell and Stanley, 1968) as was possible. In addition, it was necessary for the sampling and assignment procedure to produce sets of "dyads" in order to provide an appropriate unit of analysis for statistical tests. As a result of these considerations the following sampling plan was designed: (1) each of the 511 students who were enrolled in the course for the first time during Spring Term, 1974, was assigned a number; (2) 100 random numbers ranging from 1 to 511 were generated; (3) the students who were assigned the first 25 numbers so generated constituted the set of "primary" learning cell members for the structured learning cell treatment, the students who were assigned the second 25 numbers constituted the set of "primary" learning cell members for the unstructured learning cell treatment, the students who were assigned the third 25 numbers constituted one set of members for the control treatment, and the students who were assigned the fourth 25 numbers generated constituted a second set of members for the control treatment; (4) each of the 25 subjects in the structured learning cell treatment and each of the 25 subjects in the unstructured learning cell treatment were asked to select a partner from the remaining population of students; and (5) each of the 25 subjects in one of the

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control treatment sets was randomly assigned a "partner" from the other control treatment set to produce 25 pairs of learners, thus creating a similar unit of analysis for the control group.

This procedure produced a potential sample size of 150 participants for the study, fifty of whom were to be selected by "primary" learning cell members. Although this sampling and assignment plan seemed to guard against the reactive effects of experimental arrangements and also provided an appropriate unit for statistical analyses, it did, nevertheless, violate certain sampling principles that were considered to be of less importance by comparison. For example, it was likely that subjects in different experimental treatments would belong to the same Interpersonal Process Laboratory (IPL) and therefore possibly discuss the treatments with one another, thus destroying independence among the three treatments. However, in this case the IPL would then have been the unit of statistical analysis, and with only 38 IPL sections available, the number of experimental units would be rather small for purposes of analysis. In addition, the composition of learning cells would consist of members of only certain IPL sections.

The sample employed in most analyses consisted of 118 of the 150 subjects potentially available for the study. Fourteen "primary" learning cell members in the

structured treatment did not select a partner and fourteen "primary" learning cell members in the unstructured treatment also did not select a partner. In addition, data were inappropriately processed for two learning cells that had a "secondary" partner in common, thus four additional subjects were not included in some analyses. Several students had already begun Unit II by the time the experimenter could meet with them about participating in the project and others requested that they be omitted from the study, usually on the basis that they were encountering great difficulty in finding someone to work with them.

Of the 118 subjects, 39 were men and 79 were women. Underclassmen comprised 54.0% of this group, whereas 40.7% were upperclassmen, 3.5% were special program undergraduates, and 1.8% were graduate students. Slightly more than 80% of the sample was enrolled in a program related to education, primarily either on the pre-education level or in a dual enrollment arrangement with the College of Education. Academic majors ranged across a number of areas, but education with 35.5%, the fine arts with 10.9%, human ecology with 12.7%, English with 6.8%, and the sciences with 6.6% of the total, were the most heavily represented. The mean grade point average, based on 111 observations, was 2.781 with a standard deviation of 0.517.

### Materials and Facilities

Instruction on "The Task Demands of Teaching" phase of the course focused on a conceptual model of the teaching process similar to "The Basic Teaching Model" developed by Glaser (1962) and refined and adapted for the course by Henderson (1972). Instructional content was divided into four main units or modules. Each unit consisted of written materials, cassette films or slide-tapes, and mastery examinations. Unit I, "An Introduction to Teaching," presented an overview of the course and some preliminary materials on teaching. In Unit I the student was introduced to the components of "The Tasks of Teaching" and their interrelationships. Each of the first three of these tasks, Assessment, Goal Setting, and Strategy Selection, served as the focus for one of the following three units. Thus, the other major units of instruction were "Unit II: The Process of Assessment," "Unit III: The Process of Goal Setting," and "Unit IV: The Process of Strategy Selection." The text, Education 200: The Individual and the School (Henderson, 1972), contained only a brief discussion of Evaluation, the fourth and final task of teaching.

The instructional procedures considered in the present study were employed in the last three units. In general, the text material for each of these units, as well as the first, contained a list of performance

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objectives, a pretest, an overview or introduction, and a set of mini-lessons on important concepts and/or a guidebook for carrel programs. Several units also contained unit practice examinations. Cassette films or slide-tapes which illustrated the application of each component of "The Tasks of Teaching" model were available in a carrel room. Mastery evaluations for each unit were administered in a separate carrel testing room; tutors were available for grading mastery evaluations and helping to explain material to students.

### Measures

Data collection procedures were designed to produce as little interference with routine course activities as was possible. Three of the six instruments used in this study were regularly employed by the course for purposes of evaluation: (1) the Unit Mastery Evaluation; (2) the Unit Reactionnaire; and (3) the End-Term Evaluation. The remaining three instruments were designed specifically for this study; they were: (1) the Activities Log; (2) the Post-Instruction Questionnaire; and (3) the Interview Schedule.

### Unit Mastery Evaluations

Student learning of the content of each instructional unit was assessed by means of a Unit Mastery

Evaluation. Test items were derived from the objectives of instruction. Instructional procedures reflected the learning objectives. Since the mastery evaluation instruments had been continuously improved and modified over a number of terms, those used in this study were relatively free of ambiguous phrasing and inappropriate questions; they were essentially the same evaluation instruments that had been successfully employed during the preceding term. Testing personnel were quite familiar with the instruments so there were few administrative problems involved in their use. The mastery evaluations seemed to possess both content and face validity.

In general, each Unit Mastery Evaluation was divided into several sections, usually four or five in number. Each section dealt with a major concept from the course material. Evaluation items frequently presented descriptions of teaching or learning situations and the student was usually required to recognize, identify, or apply the particular concept that was relevant to that situation. Thus, most of the items were at the knowledge, comprehension, or application level of cognitive complexity (Bloom, 1956). Students were required to achieve mastery at the 80% criterion level on each concept. Students failing to attain mastery on the first test trial underwent reinstruction and took the alternate test form for concepts that were missed. Unit Mastery

Evaluation scores were reported as the number of items missed, in addition to the usual mastery or non-mastery designation. This information, as well as the number of times that a student required reinstruction by tutorial staff, was recorded on a standard form for each of the four instructional units.

### Unit Reactionnaires

All students within the auto-instructional phase of the course were requested to respond to a reactionnaire upon completion of each of the four units of instruction. The basic instrument had been utilized for several previous terms, although particular items may have been added, deleted, or modified in efforts to improve it. This basic instrument was subjected to further modification for use in the present investigation. Items that had been employed with success during previous terms were retained. They had served as bases for course comparisons over terms and thus were an essential part of an ongoing, long term course evaluation program. Two new items were added to this basic set of items so that additional information pertinent to this study could be gathered. Items were also standardized across all four instructional units, thus making it possible to make intra-unit comparisons. The final product was a series of four essentially parallel Unit Reactionnaires, each

of which contained fifteen items. Each item consisted of a statement related to some aspect of the instruction on the unit; the respondent was asked to indicate his or her agreement with the statement on a five point scale which ranged from 1, "strongly agree," to 5, "strongly disagree." The items, either singly or in combination, were expected to yield information concerning the relevance of the course material and learning experience to professional teaching, the amount of perceived control the learner had over the learning experience, the variety of situations and contexts in which course content was able to be considered, the learner's self-perceived understanding of the course content, and the learner's impression of the quality of the instructional materials.

A copy of the Reactionnaire for Unit III is contained in Appendix A.

#### Activities Logs

Each learning cell partner was requested to complete an Activities Log (Appendix B) after each joint study session. This instrument was designed to collect information concerning the date, place, and duration of the study session, the kind and amount of advance preparation that each partner made in anticipation of the joint study session, the kinds of activities pursued in the joint study session, additional academic subjects studied

together, difficulties in meeting with the partner; and subjective ratings of the quality of the joint study session. In addition, four items were included in order to determine if reciprocity seemed to exist within the learning cell. These items inquired about the respondent's impression of his partner's advance preparation and willingness and ability to help, as well as the respondent's perception of his own ability to make a useful contribution to the group learning endeavor.

#### Post-Instruction Questionnaire

The Post-Instruction Questionnaire was designed for use in the present study. The instrument was to be completed by subjects in the two experimental treatments and the control treatment after they completed all four units of instruction. Reference to this instrument was initially made in the "General Procedures" guidelines for each treatment group. The instrument was made available in the carrel testing room where a sign was posted which reminded participants in the study to take a copy of the instrument, complete it, and place it in an appropriately marked box.

The Post-Instruction Questionnaire solicited open-ended responses as well as reactions to specific aspects of "The Task Demands of Teaching" phase of the course. Part I of the instrument consisted of a series of six

statements; the respondent was asked to indicate his or her level of agreement with each statement on a five point scale which ranged from "strongly agree" to "strongly disagree." These six statements were based upon comments that students from a previous term had made about "The Task Demands of Teaching" phase of the course (Shwedel, Stiggins, and Byers, 1972) and dealt with the following concerns: the pressure to complete carrel units; the opportunities for discussion of carrel-textbook concepts; the availability of tutors in the carrel testing room; the objectivity of tutors in explaining concepts; the interrelation of the Interpersonal Process Laboratory and the carrel-textbook-tutorial phase of the course, and the need to consider carrel-textbook concepts in respect to personal experiences. Part II of the instrument contained three open-ended questions concerning generally effective approaches for completing unit material, and aspects of the carrel-textbook-tutorial experience that the respondent least liked and best liked.

### End-Term Evaluation

The End-Term Evaluation had been developed over a three year period and was one of the basic data collection instruments that were utilized in an ongoing, long term evaluation program within the course. This questionnaire was completed by students in the course during

the last week of the term. The majority of questions were related to the student's perceptions of his or her experiences in the Interpersonal Process Laboratory phase of the course. However, Parts II and III of the instrument contained questions that were pertinent to the present investigation; these items dealt with the overall course, examinations and grading, tutorials, and carrels (see Appendix C).

### Interview Schedule

The Interview Schedule was specifically designed for use in this study and was utilized by the investigator as both a guide for and record of individual interviews with a selected number of learning cell participants. The schedule was employed during both telephone and in-person interviews conducted during the last two weeks of the school term.

The Interview Schedule consisted of an introductory statement and a series of questions concerning the respondent's impressions of his or her learning cell experience. The introductory statement was never read literally, but rather served as a model for the investigator's initial remarks about the purpose of the interview, the need for candid responses, assurances that remarks would not affect course grades, and general interview procedures. Interview questions dealt with the

following topics: general impressions of "The Task Demands of Teaching" phase of the course; things that the respondent liked best about the learning cell experience; activities that worked best in the learning cell; the kind of interpersonal relationships that seemed to be most effective for dyadic studying; the amount of structure that was needed for productive learning cell experiences; the kinds of situations in which learning cells worked best; the possible uses of learning cells in one's professional role as a teacher; the biggest problems with learning cell approaches; factors that would inhibit effective dyadic interactions; least successful learning cell activities; ways to improve the present investigation; and final comments.

Interview data were primarily employed in an examination of the dynamics of the learning cell. These data were used in two case studies as well as in a consideration of general research questions about the learning cell.

### Design

This section is divided into two major parts: Original Design Plan, and Modified Design. A change in design was necessitated after the study was well underway because of the relatively large loss of subjects from two experimental learning cell treatments.

### Original Design Plan

The original design plan had involved three treatments: (1) the structured learning cell procedure; (2) the unstructured learning cell procedure; and (3) the control procedure. All three treatments were employed during the last three of the four units of instruction on "The Task Demands of Teaching": Unit II: The Process of Assessment; Unit III: The Process of Goal Setting; and Unit IV: The Process of Strategy Selection. Each treatment extended across these three units of instruction since it was likely that a "learning how to learn in a learning cell" phenomenon would occur, an expectation which was supported, in part, by the work of Goldschmid and Shore (1974). Unit I: An Introduction to Teaching was excluded from the treatments since it was desirable that dyad members have an opportunity to "size up" potential partners (Alexander, et al., submitted for publication) before deciding to work together for the remaining three units of instruction. The original design plan is presented in Table 1.

"Primary" learning cell members and control treatment members were met by the investigator during the first few weeks of Spring Term, usually before or after their IPL group meeting was scheduled. Each of these students was informed about how they were selected and the general nature of the study, and then asked to

Table 1. Original design plan.

	Unit I	Unit II	Unit III	Unit IV
R	$X_0O_1$	$X_1O_2$	$X_1O_3$	$X_1O_4$
R	$X_0O_1$	$X_2O_2$	$X_2O_3$	$X_2O_4$
R	$X_0O_1$	$X_3O_2$	$X_3O_3$	$X_3O_4$

R = random selection and assignment;

$X_0$  = usual auto-instructional procedure for Unit I;

$X_1$  = structured learning cell procedure for Units II, III, and IV;

$X_2$  = unstructured learning cell procedure for Units II, III, and IV;

$X_3$  = control procedure for Units II, III, and IV;

$O_1$  = observations on the Unit I Mastery Evaluation and Unit I Reactionnaire for all treatments;

$O_2$  = observations on the Unit II Mastery Evaluation and Unit II Reactionnaire for all treatments, as well as observations on Activities Logs for Unit II experimental subjects;

$O_3$  = observations on the Unit III Mastery Evaluation and Unit III Reactionnaire for all treatments, as well as observations on Activities Logs for Unit III experimental subjects; and

$O_4$  = observations on the Unit IV Mastery Evaluation, Unit IV Reactionnaire, End-Term Evaluation, and Post-Instruction Questionnaire for all treatments, as well as observations on Unit IV Activities Logs and the Interview Schedule for experimental subjects.

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cooperate in the study. In addition, each subject was notified that an envelope under his or her name would be available in the carrel testing room after completion of Unit I. Experimental subjects were also asked to begin thinking about a partner for the dyadic learning procedures involved in Units II, III, and IV. Precautions were taken to insure that no expectations of experimental outcomes were conveyed to any learners; all treatments were presented as very positive approaches for learning course material.

The first experimental treatment, the structured learning cell, was designed to represent an instructor-selected set of learning procedures. This treatment was based upon the idea that sound structure and proper management were necessary for successful learning cell experiences (Kingsbury, 1968; Goldschmid, 1971). The sequence of learning activities for the structured treatment was the following: (1) each partner individually studied the unit material, made a list of points in the material that were unclear, and prepared at least one question that was designed to check his or her partner's understanding of an important point in the material; (2) partners brought their lists of unclear points and questions to the joint study session, clarified the areas of misunderstanding, asked their questions, and mutually decided upon the correct answers; (3) partners

then participated in a mini-teaching experience in which each partner employed the task of teaching (assessment, goal setting, or strategy selection) under consideration in that particular unit; (4) each partner independently completed an Activities Log for the joint study session; and (5) each partner turned in his or her Activities Log in the carrel testing room, usually at the time that the Unit Mastery Evaluation was taken. Although the activities in the structured learning cell treatment were expected to involve more effort on the part of subjects than the other two treatments, all of the activities were considered to be related to the course material and seemed to provide appropriate and relevant practice for the learners. A copy of the "General Procedures" for the structured learning cell treatment is contained in Appendix D.

The second experimental treatment, the unstructured learning cell, was designed to represent a dyad-controlled set of learning procedures. This treatment was based upon the idea that learners who had been provided with a set of behaviorally stated objectives, such as those contained in each unit of instruction, could best determine what learning activities were most beneficial for them (Mager, 1961; Mager and Clark, 1963). The minimum activity that was required was that dyad partners met to study the material in each unit before

they took the Mastery Evaluation. Learners were given relatively complete control over what, where, how, and when they studied together. As in the structured learning cell treatment, subjects were asked to independently complete an Activities Log and turn it in to the carrel testing room. A copy of the "General Procedures" for the instructional learning cell treatment is contained in Appendix E.

The control treatment closely approximated the auto-instructional procedures which were regularly employed in the course. However, the subjects in this treatment were given the opportunity to read any of six reprint articles that were related to the last three units of instruction. These articles were available in the carrel testing room. In addition, control subjects as well as experimental subjects, were informed that the investigator would like them to complete a special questionnaire (Post-Instruction Questionnaire) concerning their learning experience during the term; this was to be picked up in the carrel testing room after the learner had completed Unit IV. A copy of the "General Procedures" for the control treatment subjects is contained in Appendix F.

### Modified Design

The original design plan was modified since the number of functioning learning cells for each treatment was much smaller than anticipated, thus greatly reducing the statistical power necessary for analysis. In addition, interviews with select learning cell members at the end of the term indicated little evidence that those subjects assigned to the structured learning cell treatment had, in fact, adhered to the guidelines established for that treatment. Thus, structured learning cells appeared to differ little from unstructured learning cells.

A modified experimental design evolved out of this set of circumstances. In this modified design, the two experimental treatments were combined to form a general group of viable learning cell subjects. For purposes of data analysis, a "viable dyad" for a particular unit of study was defined as one in which at least one Activities Log was received from a dyad member, a Unit Mastery Evaluation was taken by at least one dyad member, and only the same individuals worked together in the learning cell during the term.

At least one completed Activities Log for a particular unit of instruction was considered to be a minimal indication that dyads had, indeed, worked together for that particular unit. There were instances where some dyad members reported studying together for a Unit Mastery

Evaluation, and yet, one member never actually took the Evaluation. In this situation, the learning cell could be defined as "viable" since it seemed likely that the completed Activity Logs were true records of joint-study efforts directed toward attaining mastery of the unit; if both members of the dyad had not taken the Unit Mastery Evaluation, however, the validity of the submitted Activities Logs would have been more suspect. The last requirement in order for a learning cell to be classified as "viable" was that the same partners worked together throughout the term. This criterion was more arbitrary than the others and was included to cover instances in which an individual participated in two or more dyads during the term. This criterion seemed to insure that the learning cell under consideration was, indeed, a stable one.

"Non-viable" learning cell subjects were those individuals who had been either designated as "primary" learning cell partners but had failed to satisfy the criteria for "viability" for a particular unit or were "secondary," i.e., chosen, partners who had also failed to satisfy the criteria for "viability" for a particular unit.

The following number of viable learning cells participated in each unit of instruction: Unit II, 15; Unit III, 13; and Unit IV, 11.

In some analyses, the viable learning cell subjects were compared with non-viable learning cell subjects.

In other analyses, viable learning cell subjects were compared with subjects from both the non-viable learning cells and the control treatment combined. In both instances, the unit of statistical analysis was the individual subject, rather than the dyad.

In addition to the modified experimental design, post hoc investigations in the form of case studies were used to examine learning cell processes in greater detail. Information for the case studies was gathered by all six of the instruments that were described earlier, although the Activities Log and Interview Schedule were the primary data collection instruments employed.

#### Research Questions and Testable Hypotheses

In general, the addition of a learning cell approach to "The Task Demands of Teaching" (auto-instructional) phase of the course was expected to produce the following outcomes: (1) provide conditions for effective learning; (2) alleviate course administrative difficulties; and (3) improve student perceptions of the course. In addition, one of the primary research objectives in the present investigation was to examine the characteristics of learning cells, factors that contributed to or detracted from effective learning cell operations, and attitudes of dyad members toward the learning cell approach. Several of the

characteristics of learning cells could be assessed in the form of testable experimental hypotheses; however, others were more amenable to a general research question format and a more descriptive investigative approach using data from personal interviews and records of learning cell encounters.

### Experimental Hypotheses

Conditions for Effective Learning.--Learning cell strategies were expected to provide important sources of intrinsic motivation as well as opportunities for active learning, practice, and feedback.

Three sources of motivation were expected to operate within the learning cells working on the last three units of instruction in "The Task Demands of Teaching" phase of The Individual and the School course: (1) the need to reciprocate (Bruner, 1968, 1972); (2) the opportunity to exert a relatively large amount of control over one's learning experiences (Mager, 1961; Mager and Clark, 1963); and (3) the opportunity to engage in a task that appears to be personally relevant, i.e., teaching another as well as studying for oneself.

The need to reciprocate as a source of motivation is considered in the section on general research questions concerning the characteristics of the learning cell. However, testable hypotheses for the latter two sources of

motivation were formulated for experimental investigation:

- H<sub>1</sub>: Viable learning cell subjects in comparison to subjects in non-viable learning cells will express greater agreement, on the average, with a statement on each Unit Reactionnaire concerning the subject's ability to exercise an appropriate amount of personal control over the way in which unit material was studied.
- H<sub>2</sub>: Viable learning cell subjects in comparison to subjects in non-viable learning cells will express greater agreement, on the average, with a series of three positive statements on each Unit Reactionnaire concerning the relevance of the unit teaching concepts to professional teaching.

A dyadic learning situation was also expected to provide important opportunities for learner practice and feedback. Several testable hypotheses were formulated to determine if these expectations were realized.

Moore and Anderson (1969) had suggested that learning would be more complete if the environment would provide the learner with opportunities to view the subject from a great number of perspectives. It has been argued that the learning cell environment can supply these opportunities. The following testable hypothesis was based upon this belief:

- H<sub>3</sub>: Viable learning cell subjects in comparison to subjects in non-viable learning cells will express greater agreement, on the average, with a statement on each Unit Reactionnaire concerning the subject's ability to consider the particular task or teaching process for that unit (assessment, goal setting, or strategy selection) in a variety of situations and contexts.

Certain features of the learning cell, e.g., consideration of the subject matter from different perspectives, active learning, practice using the course material, and immediate and relevant feedback (Moore and Anderson, 1969; Kingsbury, 1968; Goldschmid, 1971; Alexander, et al., submitted for publication) were expected to improve the quality of learning as the following hypotheses suggest:

- H<sub>4</sub>: Viable learning cell subjects in comparison to subjects in non-viable learning cells will express greater agreement, on the average, with a series of four positive statements on each Unit Reactionnaire concerning the subject's understanding of the unit content.
- H<sub>5</sub>: Viable learning cell subjects in comparison to subjects in non-viable learning cells will, on the average, miss fewer items on Unit Mastery Evaluations.
- H<sub>6</sub>: Viable learning cell subjects in comparison to subjects in non-viable learning cells will attain a higher percentage of mastery on Unit Mastery Evaluations.

Alleviation of Course Administrative Difficulties.--The addition of a learning cell approach to "The Task Demands of Teaching" phase of the course was expected to alleviate course administrative difficulties in two ways: (1) reduce the number of reinstructions by carrel room tutors; and (2) encourage learners to complete unit mastery examinations earlier in the term. It was anticipated that dyad members, by carefully monitoring their partner's learning, would reduce the number of inadequately

prepared test-takers and therefore reduce the amount of reinstruction required. Since dyad members would work together on unit modules, it was also anticipated that peer pressures to maintain a more evenly paced schedule of study would reduce the number of students who waited until late in the term to finish the course, a situation that created problems for carrel room staff, as well as students.

Two testable hypotheses were formulated on the basis of these expectations:

- H<sub>7</sub>: Viable learning cell subjects in comparison to subjects in non-viable learning cells will require, on the average, fewer reinstructions for each unit of instruction.
- H<sub>8</sub>: Subjects in a viable learning cell sometime during the term will take each Unit Mastery Evaluation sooner, on the average, than will subjects in non-viable learning cells for the entire term and the control group combined.

The dependent measures in Hypothesis 8 were not independent across units of instruction; e.g., an early start on Unit I may contribute to an early start on the following three units of instruction. Thus it was necessary in Hypothesis 8 to examine viable learning cells that existed sometime during the term; other testable hypotheses involved relatively independent measurements for each unit of instruction.

#### Improvement of Student Perceptions of the Course.--

Since a learning cell strategy appeared to facilitate

effective learning so well, it was anticipated that learning cell participants would find their learning experiences and perceptions of the course to be more positive than would non-participants. The following testable hypotheses were based upon this expectation:

- H<sub>9</sub>: A higher percentage of subjects in a viable learning cell sometime during the term in comparison to subjects in non-viable learning cells for the entire term and the control group combined, will choose "The Task Demands of Teaching" phase of the course as that aspect of the course that contributed most to thinking about a career in education, as measured by an item on the End-Term Evaluation.
- H<sub>10</sub>: Subjects in a viable learning cell sometime during the term will rate selected features (examinations, grading, tutorials, and carrels) of "The Task Demands of Teaching" phase of the course more positively, on the average, than will subjects in non-viable learning cells for the entire term, as measured by a series of five items on the End-Term Evaluation.
- H<sub>11</sub>: Viable learning cell subjects in comparison to subjects in non-viable learning cells will rate certain aspects (opportunities for discussion of carrel-textbook concepts, the need to consider carrel-textbook concepts in respect to personal experiences, and the interrelation of the Interpersonal Process Laboratory and the carrel-textbook phase of the course) of "The Task Demands of Teaching" phase of the course more positively, on the average, than will non-viable learning cell subjects, as measured by three items on the Post-Instruction Questionnaire.
- H<sub>12</sub>: Subjects in a viable learning cell sometime during the term will rate the Education 200 course more positively, on the average, than will subjects in non-viable learning cells for the entire term as measured by three questions on the End-Term Evaluation.

### General Research Questions and Case Studies

A number of general research questions concerning the learning cell were examined in this study. These questions were exploratory in nature and were formulated more as guidelines for investigation rather than formal statistical hypotheses. Results were described in two case studies, as well. Data were primarily based on personal interviews and Activities Logs of learning cell sessions.

The following general research questions concerning viable learning cells were investigated:

1. What proportion of potential learning cells were viable during the term?
2. Where did learning cell activities take place?
3. How long did learning cell meetings last?
4. How much time was actually spent in studying together?
5. How much time was spent in advance preparation for learning cell sessions?
6. What kinds of activities were done in advance preparation for learning cell sessions?
7. What kinds of activities were done in learning cells?
8. Did learning cells study additional subject matter areas together?
9. Was there evidence of reciprocal relationships in learning cells?
10. What were dyad members' impressions of their joint study sessions?

11. What did dyad members like best about the learning cell experience?
12. What did dyad members do together that worked best?
13. What were dyad members' opinions about the kinds of interpersonal relationships that were most effective for dyadic studying?
14. What were dyad members' opinions about the amount of structure that was necessary for productive learning-teaching experiences?
15. What were dyad members' opinions about the kinds of situations in which learning cells were most appropriate?
16. How did dyad members perceive themselves using learning cell strategies in their own teaching?
17. What did dyad members like least about learning cell approaches?
18. What did dyad members do that was least successful?

### Analyses

Experimental hypotheses were tested by either a one factor analysis of variance, fixed effects model, or a chi-square test of homogeneity of proportions. The analysis of variance procedure was appropriate for use with dependent variables that were on an ordinal scale of measurement, whereas the chi-square procedure was appropriate for use with the dependent variables that were on a nominal scale.

### Summary

The sample for this study was primarily composed of undergraduate students enrolled in an introductory course in teacher education. Members of the sample were randomly assigned to one of three treatment groups in the original design plan, but an unexpectedly large loss of experimental subjects resulted in a modified design that primarily consisted of two treatment groups, one composed of viable learning cell members, and the other composed of non-viable learning cell members. The scores on dependent measures of members of the original control treatment were combined with this latter group for some analyses. A one factor analysis of variance procedure was employed to test some experimental hypotheses. Others were tested by a chi-square test for homogeneity of proportions. Dependent variables were related to examination performances and questionnaire ratings of subjects in the sample. In addition, data of a descriptive nature were collected, primarily through the use of personal interviews and records of learning cell encounters. These data provided information for two case studies as well as for a general discussion of learning cell characteristics.

## CHAPTER IV

### RESULTS

The results of the study are reported in this chapter. Experimental hypotheses concerning the effectiveness of the learning cell are considered first. Findings regarding the characteristics of processes of the learning cells are presented next. The chapter concludes with two case studies of peer assisted learning.

#### Experimental Hypotheses

Twelve experimental hypotheses concerning the expected benefits of a learning cell approach were examined in this study. Six of these hypotheses involved the effectiveness of the learning experience, two others dealt with the alleviation of course administrative difficulties, and the remaining six were directly related to the improvement of student perceptions of the Individual and the School course.

#### Effective Learning

Viabile and non-viable learning cells were compared on the basis of six dependent measures that were presumed

to be indicative of effective learning: (1) the learner's perceived ability to exert an appropriate amount of personal control over his or her learning; (2) the learner's perception of the relevance of the unit concepts to professional teaching; (3) the learner's perceived ability to consider the tasks of teaching in a variety of situations or contexts; (4) the learner's perception of his or her understanding of the instructional content for each unit; (5) the number of items that the learner missed on the Mastery Evaluation for a particular unit of instruction; and (6) the learner's attainment of mastery or non-mastery on the first trial of the Mastery Evaluation for a particular unit of instruction. The number of cases, mean, standard deviation, statistical test result, and associated experimental hypothesis are presented by unit of instruction in Table 2 for the first five dependent measures. Table 3 contains the total number of cases and percentages of mastery and non-mastery by unit of instruction, the dependent measure for Hypothesis 6.

None of the six directional hypotheses regarding effective learning were accepted. Statistical tests indicated no significant differences at the  $\alpha = .05$  level between viable and non-viable learning cells on any of the dependent variables--perceived personal control over learning, perceived relevance of unit content to teaching, perceived variety of contexts in which material was



3

Variety of  
Contexts Con-  
sidered (Unit  
Reactionnaire  
Item 8)

Non-Viable	20	2.200	.768	25	2.280	.678	25	2.080	.702
Viable	18	2.167	.515	16	2.813	1.109	15	2.067	.799
ANOVA	df= 1, F=.024, NS		df= 1, F=3.660, NS		df= 1, F=.003, NS				
	<u>36</u>		<u>39</u>		<u>38</u>				

4

Understanding of  
Unit Content  
(Unit Reaction-  
naire Items 1,  
10, 11, 12)

Non-Viable	8	10.000	2.000	17	9.412	1.372	*
Viable	6	8.833	1.941	8	10.625	1.847	
ANOVA	df= 1, F=1.196, NS		df= 1, F=3.411, NS				
	<u>13</u>		<u>23</u>				

5

Number of Test  
Items Incorrect  
(Unit Mastery  
Evaluations)

Non-Viable	38	3.447	2.920	42	4.095	3.668	46	1.413	1.950
Viable	30	3.133	2.713	26	3.808	2.684	22	2.000	2.778
ANOVA	df= 1, F=.206, NS		df= 1, F=.120, NS		df= 1, F=1.016, NS				
	<u>66</u>		<u>66</u>		<u>66</u>				

---

\*Data were improperly processed.

Table 3. Variable matrix for hypothesis 6 with percentage of viable and non-viable learning cell subjects who attained either mastery or non-mastery by unit of instruction.

Hypothesis	Dependent Measure	Unit II		Unit III		Unit IV	
		Non-Viable Ss	Viable Ss	Non-Viable Ss	Viable Ss	Non-Viable Ss	Viable Ss
6		n=30	n=29	n=34	n=24	n=36	n=20
	Mastery	50.0%	69.0%	47.1%	58.3%	72.2%	75.0%
	Non-Mastery	50.0%	31.0%	52.9%	41.7%	27.8%	25.0%
	$\chi^2$ test:	df=1, $\chi^2=1.482$ , NS		df=1, $\chi^2=.336$ , NS		df=1, $\chi^2=.008$ , NS	

considered, perceived understanding of unit content, number of items on Unit Mastery Evaluations that were incorrect, and percentage of mastery and non-mastery on Unit Mastery Evaluations.

#### Alleviation of Course Administrative Difficulties

Two experimental hypotheses reflected expectations that implementation of the learning cell in The Individual and the School would alleviate certain administrative difficulties within the course. Table 4 presents the variable matrix for the independent and dependent variables involved in these two hypotheses.

Analysis of the data failed to demonstrate that participation in a learning cell helped to alleviate course administrative difficulties. No significant differences ( $\alpha = .05$ ) were found between viable learning cell subjects and non-viable learning cell subjects (or non-viable and control subjects combined) in terms of the number of carrel room reinstructions required or the rate at which Unit Mastery Evaluations were first taken.

#### Improvement of Student Perceptions of the Course

Four experimental hypotheses were tested which reflected the expectation that learning cell participants would tend to find their learning experiences and perceptions of the course to be more positive than would non-participants.

Table 4. Variable matrix for hypotheses 7 and 8 concerning the alleviation of course difficulties with means, standard deviations, and ANOVA results of treatment groups by unit of instruction.

Hypothesis	Dependent Measure	Unit I			Unit II			Unit III			Unit IV		
		n	$\bar{x}$	S.D.	n	$\bar{x}$	S.D.	n	$\bar{x}$	S.D.	n	$\bar{x}$	S.D.
7	Number of Car-rel instructions												
	Non-Viable	38	.658	.708	38	.395	.495	42	.500	.634	46	.217	.417
	Viable	30	.800	.714	30	.300	.466	26	.462	.647	22	.227	.429
	ANOVA	df= 1, F=.670, NS			df= 1, F=.646, NS			df= 1, F=.058, NS			df= 1, F=.008, NS		
		<u>66</u>			<u>66</u>			<u>66</u>			<u>66</u>		
8	Number of Days Expired Before Taking Unit Mastery Evaluation												
	Non-Viable and Control Combined	71	18.761	10.046	66	27.591	10.081	66	34.349	11.200	62	41.339	9.551
	Viable	34	19.441	7.492	33	28.879	5.527	32	37.375	5.326	30	44.600	3.212
	ANOVA	df= 1, F=.123, NS			df= 1, F=.467, NS			df= 1, F=2.098, NS			df= 1, F=3.301, NS		
		<u>103</u>			<u>97</u>			<u>96</u>			<u>90</u>		

\*Summary data are based on the performance of the same subjects who were in viable or non-viable learning cells for Unit II.

Table 5 presents the percentages of combined non-viable and control subjects and the percentages of viable learning cell subjects who, on Item 12 of the End-Term Evaluation (Appendix C), selected various aspects of The Individual and the School course as contributing the most to their thinking about a career in Education. Since carrels, texts, and testing-reinstruction are components of "The Task Demands of Teaching" phase of the course, the percentages for these components have been combined in order to produce a basis for comparison with the Interpersonal Process Laboratory (IPL) and the lecture experiences.

The second experimental hypothesis concerning the improvement of student perceptions dealt specifically with the auto-instructional phase of the course. Table 6 presents the data for Hypothesis 10.

The only question concerning features of "The Task Demands of Teaching" phase of the course that elicited responses that were significantly different at the  $\alpha = .05$  level for subjects in viable learning cells and subjects in non-viable learning cells and the control group in combination was, "How do you feel about the testing-tutorial system used in ED 200?" The response scale ranged from 1, "Very Unfavorable," to 5, "Very Favorable." Although subjects in viable learning cells seemed to find the testing-tutorial system more favorable than their



Table 6. Variable matrix for hypothesis 10: End-Term Evaluation ratings of selected features of "The Task Demands of Teaching" phase of the course by viable and non-viable learning cells.

Dependent Measure	n	$\bar{x}$	S.D.
<b>Adequacy of Exams</b>			
Non-Viable and Control	70	1.200	.469
Viable	26	1.423	.703
ANOVA: $df = 1$ , $F = 3.219$ , NS			
<u>94</u>			
<b>Fairness of Grading System</b>			
Non-Viable and Control	70	1.086	.371
Viable	26	1.115	.432
ANOVA: $df = 1$ , $F = .111$ , NS			
<u>94</u>			
<b>Subject Matter Competency of Tutors</b>			
Non-Viable and Control	67	2.299	.652
Viable	26	2.500	.648
ANOVA: $df = 1$ , $F = 1.796$ , NS			
<u>91</u>			
<b>Testing-Tutorial System</b>			
Non-Viable and Control	69	3.406	3.406
Viable	26	4.154	4.154
ANOVA: $df = 1$ , $F = 7.019$ , S			
<u>93</u>			
<b>Number of Carrels Taken</b>			
Non-Viable and Control	70	2.843	1.594
Viable	26	3.192	1.327
ANOVA: $df = 1$ , $F = .992$ , NS			
<u>94</u>			

counterparts in the other treatment group, these data must be regarded with caution for several reasons. The sample sizes are relatively small. Secondly, the range of responses, i.e., a five point scale, is larger than the three point scale employed in the other measures, and thus may permit greater variability in responses. Finally, the term "testing-tutorial system" may, and probably does, mean different things to participants and non-participants in learning cells; i.e., learning cell participants may perceive the term as referring to the learning cell strategy, whereas non-participants may interpret the question in relation to carrel reinstruction procedures.

The last question regarding specific features of "The Task Demands of Teaching" phase of the course was, "How many of the carrels did you take?" Potential responses to this question included the following: 1, "All of them"; 2, "7-8"; 3, "4-6"; 4, "1-3; and 5, "None." Thus, the means reported in Table 6 do not directly represent the true number of carrels taken; they represent ranges of carrels taken instead. It is also important to note that the magnitude of the reported mean is inversely related to the number of carrels taken. The difference between these groups on this measure was not significant, as Table 6 illustrates.

In addition to items on the End-Term Evaluation,

items concerning learner perceptions of other features of the course were included in a Post-Instruction Questionnaire. The three items consisted of the following statements: "There should be more opportunities for discussion of carrel-textbook concepts."; "The Interpersonal Process Laboratory and the carrel-textbook-tutorial phase of the course seem to be interrelated."; and "The carrel textbook concepts should be considered in respect to personal experiences." The response scale ranged from 1, "Strongly Agree" to 5, "Strongly Disagree." Sample sizes, means, standard deviations, and ANOVA results of non-viable and viable learning cells for each unit are reported in Table 7.

Table 8 presents sample sizes, means, standard deviations and ANOVA results for Hypothesis 12. No significant differences ( $\alpha = .05$ ) were found between treatment groups on the three items from Part III of the End-Term Evaluation.

In summary, four experimental hypotheses which reflected the expectation that the learning cell experience would improve student perceptions of The Individual and the School course were examined. In each one, differences in dependent measures between viable learning cell subjects and non-viable subjects (or non-viable and control subjects combined) were not significant at the  $\alpha = .05$  level.

11

11

Table 7. Variable matrix for hypothesis 11: Post-Instruction Questionnaire ratings by viable and non-viable learning cells for each unit of instruction.

Dependent Measure	Unit II			Unit III			Unit IV		
	n	$\bar{x}$	S.D.	n	$\bar{x}$	S.D.	n	$\bar{x}$	S.D.
Opportunities for Discussion									
Non-Viable	5	2.600	.894	6	2.500	.837	6	2.500	.837
Viable	14	2.286	.825	13	2.308	.855	13	2.308	.855
ANOVA	df= 1, F=.513, NS			df= 1, F=.210, NS			df= 1, F=.210, NS		
		I <sub>7</sub>			I <sub>7</sub>			I <sub>7</sub>	
Interrelation of IPL and Carrel-Textbook-Tutorial Phases of the Course									
Non-Viable	5	2.400	.894	6	3.000	1.095	6	2.500	1.225
Viable	14	3.500	1.225	13	3.308	1.316	13	3.539	1.127
ANOVA	df= 1, F=3.339, NS			df= 1, F=.247, NS			df= 1, F=3.311, NS		
		I <sub>7</sub>			I <sub>7</sub>			I <sub>7</sub>	
Personal Experiences									
Non-Viable	5	2.200	1.095	6	2.500	1.225	6	2.000	1.095
Viable	14	2.143	.864	13	2.000	.707	13	2.231	.832
ANOVA	df= 1, F=.014, NS			df= 1, F=1.292, NS			df= 1, F=.260, NS		
		I <sub>7</sub>			I <sub>7</sub>			I <sub>7</sub>	

Table 8. Variable matrix for hypothesis 12: End-Term Evaluation ratings of the overall Education 200 course by viable and non-viable learning cell subjects.

Dependent Measure	n	$\bar{x}$	S.D.
Effect of Education 200 on Desire to Teach			
Non-Viable and Control	71	1.493	.715
Viable	26	1.346	.562
ANOVA	df = $\frac{1}{95}$ , F = .893, NS		
Contribution of Education 200 to Ability to Teach			
Non-Viable and Control	71	1.127	.335
Viable	26	1.077	.272
ANOVA	df = $\frac{1}{95}$ , F = .463, NS		
Comparison of Education 200 with Other Courses Taken at MSU			
Non-Viable and Control	71	1.535	.629
Viable	26	1.346	.485
ANOVA	df = $\frac{1}{95}$ , F = 1.926, NS		

## Discussion

No significant differences between viable and non-viable learning cell treatments were detected in terms of six dependent measures that were presumed to be indicative of effective learning.

With the possible exception of the hypotheses involving the number of test items incorrect and the mastery/non-mastery scores, the sample sizes for the statistical tests were relatively small, thus increasing the likelihood of finding no significant differences between treatments. The range of possible responses on the Unit Reactionnaires may also have been too narrow to detect differences between treatments. Essentially the same problem may exist for the other two dependent measures, test items incorrect, and mastery/non-mastery scores; i.e., one would expect little variability in achievement scores when a mastery-based testing model is employed.

Data from the case study and exploratory research phase of the investigation indicated that a great number of students felt that the course material was well presented and easy to learn. Thus, the unit content may have already been presented in a variety of contexts and the relevance and understading of the content may have communicated as well.

With respect to the learner's perceived ability to exert an appropriate amount of personal control over his or her learning, it is possible that a viable learning cell member could actually have less personal control

over his learning because of pressures to accommodate the wishes of his partner. Another alternative explanation is that non-viable dyad members may exert more control over their learning by not participating in a learning cell.

It was expected that implementation of the learning cell approach would alleviate certain course administrative problems. However, this prediction was not supported by the results of this study.

One dependent measure, the number of reinstructions for each unit of instruction, provided a rough index of how much staff time would be required to tutor a student who failed to achieve mastery. It was presumed that in the learning cell, partners would monitor each other's learning, thus reducing the number of inadequately prepared test-takers. However, the number of reinstructions is a function of test scores and one can anticipate little variability on mastery test performances since this instructional model seeks to bring most learners to the prespecified criterion level. It is also possible that partners were either unable or unwilling to accurately monitor the other dyad member's mastery of the objectives.

Viable dyad members were expected to take Unit Mastery Evaluations relatively early in the term because of the pressures to keep up with one's partner. However,

it seems likely that, in some cases, learners may have actually slowed down their partners.

Four experimental hypotheses were tested which reflected the expectation that learning cell participants would tend to find their learning experiences and perceptions of the course to be more positive than would non-participants. In each one, differences on dependent measures between treatment groups were not significant. These results are not surprising since tests of other hypotheses did not establish that participants in learning cells had more productive, enjoyable, and relevant learning experiences than did non-participants. In addition, the ranges of many of the scales employed in the dependent measures were quite small, thus making it more difficult to detect differences between treatment groups.

In summary, the addition of the learning cell approach to "The Task Demands of Teaching" phase of The Individual and the School course was generally expected to result in (1) effective learning, (2) alleviation of course administrative difficulties, and (3) improved student perceptions of the course. Twelve specific hypotheses concerning these general expectations were formulated and tested and, in no case, was the null hypothesis rejected at the  $\alpha = .05$  level of significance.

### General Research Questions

Another objective of the study was to investigate the characteristics and dynamics of learning cells as they operated within the natural educational environment available in The Individual and the School course. Six Activities Logs were included in each "primary" subject's packet in order to record information on learning cell encounters. This information was relevant to a series of general research questions. With the relatively large loss of experimental subjects, a decision was made to interview several learning cell participants in an effort to gain additional insights into learning cells. Data that were collected via these interviews and Activities Logs provided the primary sources for answers to a number of general research questions.

Nineteen research questions of a general nature were investigated. These questions were primarily exploratory and were formulated to serve more as guidelines for inquiry rather than as bases for controlled experimentation. The characteristics and dynamics of learning cells served as the central foci of these questions. Data were principally derived from two sources, (1) Activities Logs, and (2) interviews with a number of students who had been selected for participation in the study.

Interviews were conducted toward the end of the course. The investigator talked with sixteen students

who had been asked to work in learning cells during the term. Of these sixteen students, four had not been in a learning cell for any of the three units of instruction, three had worked on only one unit, two had worked on two units, and eight of these students had studied in a learning cell for all three units of instruction. Since student schedules were quite full at the end of the term, five students were interviewed by telephone. Ten students were interviewed in person, and one student was initially interviewed by telephone and later interviewed in person. Interviews ranged from 20 minutes to 1 hour in duration; personal interviews consistently lasted over a half hour. Student comments were recorded on an Interview Schedule. In reporting the data from these interviews, an attempt was made to present an account of student responses which were either frequently emphasized or appeared to be of particular importance to the student.

In general, data from the Activities Logs were employed to answer the first ten exploratory research questions. Answers for questions 11 through 18 were primarily derived from comments that were made by students who were interviewed. However, all pertinent and reliable information, regardless of source, was used to answer a question. Thus, the data base for these general questions differed little from the one that was employed in the two case studies.

The first exploratory research question was the following:

1. What proportion of potential learning cells were viable during the term?

Of the 50 learning cells that were originally selected for participation in the study, only seventeen were viable sometime during the term. Fifteen viable learning cells completed Unit II, but that number was reduced to thirteen for Unit III, and eventually to eleven for Unit IV. Only nine of these learning cells met for each of these three instructional units. Three other learning cells met for two of the three instructional units; the return to learning cells by these learners may be attributed, in part, to their receipt of a letter from the investigator that reaffirmed the expectation that they were continuing to participate in the study. Three learning cells only met for one unit of instruction.

Although it is difficult to account for much of the relatively large loss of experimental subjects, several explanations are apparent. One "primary" dyad member, i.e., an individual who was randomly selected for participation in the study and thus responsible for selecting a partner, dropped the course during the second week of the term. Five other potential learning cell primary members had already completed Units I and II before the investigator could personally solicit their

participation in the study, i.e., within two weeks after the beginning of classes. One of these learners had actually completed the entire "Task Demands of Teaching" phase of the course by the second week.

Of the 44 potential primary partners that remained, only two seemed to express serious reservations about their ability to participate in the project. Both were married students and felt that these added responsibilities would prohibit their involvement. However, both of them seemed to make sincere efforts to work in learning cells, and one of them actually participated in a dyad that was viable for all three units of instruction.

Personal letters were received from eight primary partners regarding their inability to participate throughout the term. Reasons for non-participation were many and varied; frequently several reasons were mentioned. Outside commitments and pressures were often discussed. The need to bring up her grade point average was one of the reasons given by one woman. Another learner felt that he studied better by himself and found that the material was not difficult enough to warrant a joint-study effort. One of the most salient reasons seemed to be the difficulty in locating a partner who would cooperate. Several of these primary members reported that they could not find anyone willing to undertake a learning cell experience. Others indicated that another person had agreed to work in a

learning cell, but actually had not. In one case, this "tentative" partner had completed all of the units on her own before the primary partner had discovered it. In two other cases, primary partners indicated that they had waited for several weeks for their partners to begin working in the learning cell, and they were eventually forced to go ahead on their own in order to complete the course.

The second general research question was the following:

2. Where did learning cell activities take place?

Table 9 shows the distribution of locations where learning cell activities occurred. Since each member of a viable learning cell was requested to independently complete and submit an Activities Log for each unit of instruction, the data reported in Table 9 may include input from either one or both members of a learning cell. Dormitory rooms and lounges were the most frequently selected sites for learning cell sessions. The library, classrooms, and locations associated with the course, i.e., the carrel room, IPL room, and hallway outside of the carrel testing room, also were frequently chosen.

Table 10 presents the summary data that are pertinent to the following three general research questions:

3. How long did learning cell meetings last?
4. How much time was actually spent in studying together?

Table 9. Percentage distribution of study places by unit.

Place	Unit II n=26	Unit III n=23	Unit IV n=21	Total n=70
Dorm Room or Lounge	57.7%	52.2%	66.7%	58.6%
Library	19.2%	-	19.0%	12.9%
Apartment	-	8.7%	-	2.9%
Carrel Room	11.5%	4.3%	4.8%	7.1%
Outdoors	-	8.7%	-	2.9%
Hallway	-	8.7%	-	2.9%
Classroom	11.5%	13.0%	9.5%	11.4%
IPL Room	<u>-</u>	<u>4.3%</u>	<u>-</u>	<u>1.4%</u>
Total	99.9%	99.9%	100.0%	100.1%

5. How much time was spent in advance preparation for learning cell sessions?

The duration of study sessions, as well as time devoted to advance preparation, may be due, in part, to the nature and volume of material presented in particular units of instruction, so it is difficult to draw any definite conclusions. The percentage of time actually spent in studying together during a learning cell session appears to have increased somewhat from 73.21% for Unit II, to 82.39% for Unit III, and finally 85.86% for Unit IV. This trend may suggest that, as the number of learning cell encounters increase, dyads tend to more effectively

Table 10. Time spent in preparation for study session, time spent in study session, and actual time spent in studying together (in minutes).

	Unit II			Unit III			Unit IV			Total		
	n	$\bar{x}$	S.D.	n	$\bar{x}$	S.D.	n	$\bar{x}$	S.D.	n	$\bar{x}$	S.D.
Duration of Study Session	25	78.40	36.73	24	71.25	30.37	21	89.19	45.18	70	79.19	79.76
Actual Time Spent in Studying Together	25	57.40	34.85	23	58.70	27.73	19	76.58	43.17	67	63.28	35.74
Time Spent in Advance Preparation for Study Session	24	127.71	83.61	19	106.05	87.74	18	145.55	145.66	61	126.23	106.03

use their time together. However, mounting time pressures toward the end of the term may have also been an influential factor in this trend.

The next general research question was:

6. What kinds of activities were done in advance preparation for learning cell sessions?

Table 11 indicates that a relatively large percentage of advance preparation efforts consisted of going over the text, Education 200: The Individual and the School (Henderson, 1972). However, many of the categories of preparation activities are not mutually exclusive, e.g., reviewing pretests, self-tests, mini-lessons, unit objectives and necessary conditions of process concepts; making notes and outlines on the material; and noting questions and problems are all activities that may be included under the category "going over the text." Many dyad members reported two or more advance preparation activities.

7. What kinds of activities were done in learning cells?

As Table 12 suggests, learning cells spent much of their learning-teaching sessions asking each other questions on the unit content, reviewing unit pretests or self-tests, sharing notes on the material, and discussing points in the material that were unclear. Discussion of situations in which the unit material could be applied accounted for only 8.3% of all activities reported, a

Table 11. Percentage distribution of advance preparation activities by unit.

	Unit II	Unit III	Unit IV	Total
Preparation Activity	n=42	n=26	n=29	n=97
Went Over Text	42.9%	42.3%	37.9%	41.2%
Pretest or Self-Test	11.9%	7.7%	13.8%	11.3%
Objectives	4.8%	-	-	2.1%
Mini-Lessons/Necessary Conditions	7.1%	3.8%	10.3%	7.2%
Carrels	2.4%	-	3.4%	2.1%
Outline or Notes	16.7%	23.1%	24.1%	20.6%
Noted Questions and Problems	11.9%	19.2%	10.3%	13.4%
Examples from Past Experiences	2.4%	-	-	1.0%
Outside References	-	3.8%	-	1.0%
Total	100.1%	99.9%	99.8%	99.9%

Table 12. Percentage distribution of study session activities by unit.

Study Session Activities	Unit II n=100	Unit III n=96	Unit IV n=94	Total n=289
Read Text	9.0%	13.5%	10.6%	11.1%
Carrel Films or Slides	3.0%	2.1%	2.1%	2.1%
Questions on Material	22.0%	21.9%	17.0%	20.4%
Pretest or Self-Test	24.0%	18.8%	21.3%	21.5%
Shared Notes	7.0%	12.5%	14.9%	11.4%
Discussed Applications	9.0%	8.3%	7.4%	8.3%
Outside Materials	1.0%	1.0%	3.2%	1.7%
Discussed Unclear Points	19.0%	19.8%	22.3%	20.4%
Other	<u>6.0%</u>	<u>2.1%</u>	<u>1.1%</u>	<u>3.1%</u>
Total	100.0%	100.0%	99.9%	100.0%

fact which suggests that at least one of the potentially valuable features of the learning cell approach was not fully utilized. No large shifts in learning cell activities occurred as learning cells progressed through the instructional units, although asking each other questions on unit material decreased somewhat and there was a slight increase in note sharing.

8. Did learning cells study additional subject matter areas together?

Only one learning cell reported that it had studied together for a course other than The Individual and the School. The course was in vocational education and the dyad devoted the one session to preparation for the final examination. In a personal interview at the end of the term another student, who was randomly selected for participation in the study but who had not worked in a learning cell, stated that in the past she and her roommate had formed a learning cell to study economics, Russian history, and psychology; she reported that her grades in the latter two courses were her best ever. This student noted that she did not form a learning cell for The Individual and the School course, however, because the material was well presented in the text; it was like having a "partner in the book."

9. Was there evidence of reciprocal relationships in learning cells?

Four questions on the Activities Log were designed to assess the nature of the relationship between learning cell partners. Table 13 presents the percentages of affirmative and negative responses to each item. A large percentage of viable learning cell members perceived their partner as being adequately prepared for the study sessions, willing to spend time making sure that the material was understood by their partner, and also capable of explaining it in an understandable way. A sizeable, but relatively smaller percentage of viable learning cell members also saw themselves as being able to make a useful contribution to their partner's mastery of the unit objectives.

10. What were dyad members' impressions of their joint study sessions?

A relatively large number of members of viable learning cells found their study sessions to be helpful, as Table 14 indicates. Many also rated their sessions as being fun, but this perception appears to have diminished as the term progressed. Very few participants considered the sessions to be challenging, and although this perception changed somewhat for Unit IV, this may simply be a function of the more difficult material contained in that unit. A relatively high number of learners rated their study session for Unit II as being a waste of time. Viable dyad members for Units III and IV tended to find

Table 13. Perceptions of learning cell members regarding aspects of reciprocity.

Rating Category	Unit II	Unit III	Unit IV	Total
<b>Adequacy of Your Partner's Preparation:</b>				
	n=26	n=21	n=20	n=67
Adequate	92.3%	95.2%	85.0%	91.0%
Inadequate	<u>7.7%</u>	<u>4.8%</u>	<u>15.0%</u>	<u>9.0%</u>
Total	100.0%	100.0%	100.0%	100.0%
<b>Your Partner's Willingness To Spend Time Teaching:</b>				
	n=25	n=22	n=20	n=67
Willing	96.0%	95.5%	100.0%	97.0%
Unwilling	<u>4.0%</u>	<u>4.5%</u>	<u>0.0%</u>	<u>3.0%</u>
Total	100.0%	100.0%	100.0%	100.0%
<b>Your Partner's Ability To Explain Material:</b>				
	n=23	n=20	n=20	n=63
Able To Explain	91.3%	95.0%	95.0%	93.7%
Unable To Explain	<u>8.7%</u>	<u>5.0%</u>	<u>5.0%</u>	<u>6.4%</u>
Total	100.0%	100.0%	100.0%	100.1%
<b>Your Ability To Contribute to Your Partner's Mastery of the Objectives:</b>				
	n=24	n=21	n=20	n=65
Able To Contribute	79.2%	90.5%	85.0%	84.6%
Unable To Contribute	<u>20.8%</u>	<u>9.5%</u>	<u>15.0%</u>	<u>15.4%</u>
Total	100.0%	100.0%	100.0%	100.0%

Table 14. Percentage distribution of study session ratings by unit.

	Unit II	Unit III	Unit IV	Total
Rating	n=45	n=42	n=41	n=128
Helpful	37.8%	42.9%	39.0%	39.8%
A Waste of Time	17.8%	7.1%	4.9%	10.2%
Fun	17.8%	28.6%	12.2%	19.5%
Inconvenient	17.8%	14.3%	22.0%	18.0%
Boring	6.7%	4.8%	9.8%	7.0%
Challenging	<u>2.2%</u>	<u>2.4%</u>	<u>12.2%</u>	<u>5.5%</u>
Total	100.1%	100.1%	100.1%	100.0%

their sessions less of a waste of time. However, it is likely that those individuals who had initially perceived the learning cell experience as being a waste of time would tend to discontinue meeting together and thus not be represented in the ratings for the last two units of instruction. One rating that was both sizeable and consistent was the inconvenience caused by the learning cell meeting, primarily because of difficulties in finding times when both partners could meet.

11. What did dyad members like best about the learning cell experience?

Those students who were interviewed most frequently mentioned that one of the best features of the learning

cell was the opportunity it afforded to clarify course concepts through discussion. Several learners also stated that they were able to understand the material better since they had to explain it to their partner. One individual reported that she felt more confident about her understanding of the material because her ideas received reinforcement from her partner. The social benefits of working in dyads were cited by students who found the experience to be disappointing academically. Those with more positive feelings about the educational value of the learning cell experience also frequently emphasized social aspects. Several close friendships appear to have evolved out of learning cells. One learner noted that working in a learning cell was much better than studying alone and two other learners stated that they enjoyed learning the material with someone who was at the same level of understanding.

12. What did dyad members do together that worked best?

Two activities appear to have been particularly effective: asking each other questions on material that was unclear; and working through pretest and self-test items together until agreement was obtained. Both of these activities seemed to help the learners clarify important concepts.

13. What were dyad members' opinions about the kinds of interpersonal relationships that were most effective for dyadic studying?

One frequent response to this question was that both partners needed to be seriously committed to learning the material. Another related response that was often expressed was the sharing of similar viewpoints on moral and philosophical matters. A large number of comments were concerned with the discomfort that was felt when one's partner had a slower study pace; i.e., many learners hated to pressure their partners to keep up. Several students mentioned that a really good interpersonal relationship between dyad members can often present problems because partners are more likely to go off on tangents instead of studying the material.

14. What were dyad members' opinions about the amount of structure that was necessary for productive learning-teaching experiences?

Of the 17 learning cells that were viable sometime during the term, 10 had been assigned to Treatment #1, the structured learning cell procedure. Six of these dyads completed all three units of instruction as members of learning cells. However, it appears as if only one of these six learning cells followed the "structured" guidelines (Appendix D) that were provided in their packets, and that was only for Unit II. Several reasons are suggested by the data as to why these learners did not follow the guidelines. In the interviews, one student

stated that she and her partner just did not feel that the activities were relevant; they already knew what they wanted to get out of the study session, and the activities suggested in the guidelines appeared to be too structured for them.

The structured activities were designed to provide opportunities for learning cell members to practice using major course concepts in realistic situations. Yet, the learning cell that tried the structured activities during the Unit II study session also reported that these activities seemed irrelevant. During her interview, a member of this particular dyad stated that she and her partner were primarily interested in doing what was needed to pass the test, and they felt that performance of these additional activities was not necessary to reach that goal. Another student reported that she and her partner went over the guidelines, and decided that too much work was involved.

Although a few interviewees acknowledged that structured activities might be beneficial for some learners, almost everyone felt that the dyad should have control over the activities that it pursues. One student from the unstructured group stated that people probably would not do the learning cell if activities were more highly specified. Another student saw value in being provided with a topic and recommendations as to ways to

approach the material. Another student felt that partners should have been assigned and that suggestions should have been provided concerning time limits for completion of units. Finally, a number of students mentioned that the unit objectives seemed to provide all the structure that was necessary; the objectives seemed to make it clear as to what needed to be done in order to learn the material.

15. What were dyad members' opinions about the kinds of situations in which learning cells were most appropriate?

A large variety of opinions were offered in response to this question. Several students felt that informal settings, preferably quiet ones, were appropriate. Others emphasized the use of learning cells in the classroom, e.g., working with timid children, individuals who were not motivated to work independently, and students who were slow learners or ineffective test-takers. One person thought that the learning cell would work well with partners from different ethnic backgrounds.

A number of students indicated that the learning cell was a good teaching strategy, but inappropriate for The Individual and the School because the material was already well presented and rather easy to learn by oneself. One student saw the learning cell as most useful for learning new material and another student thought that the learning cell could be best used in subjects such as science and math where the correct answers are rather straight-forward.

16. How did dyad members perceive themselves using learning cell strategies in their own teaching?

Many students felt that they could use the learning cell approach with colleagues, i.e., working together in preparing for team-teaching efforts and developing new programs. A large number of students equated the learning cell strategy with tutoring and suggested that students could be quite effective in working with peers who were either slow learners, extremely timid, or unconfident about their abilities. One interviewee felt that peer instruction was particularly attractive because it broke down barriers that usually exist between teachers and students, and thus permitted the student to receive feedback in a less degrading, yet responsive way. Another interviewee indicated that she would have her students use the learning cell approach in covering assigned library readings on topics that were introduced in class lectures.

17. What did dyad members like least about learning cell approaches?

Several problems with the learning cell strategy were clearly evident. A number of students stressed that it was difficult to find a time and place to meet which was convenient for both partners. Several others emphasized that partners were often unprepared for the learning cell study sessions and thus a great deal of time was lost. Another related complaint concerned difficulties with partners who were behind in their studies, thus

causing unnecessary delays for the other member of the dyad. Several students stated that they already knew the material quite well before meeting with their partner, and thus additional coverage of the topic was a waste of time. Other students expressed great discomfort in having to ask a partner to work with them.

18. What did dyad members do that was least successful?

Most interviewees had little to say in response to this question. One student did mention, however, that just going over the reading material was a waste of time since much of it did not seem to be on the Unit Mastery Evaluations. She felt that the sessions were much more productive when she and her partner worked together on unit self-tests. Another student felt that watching carrels together was unhelpful. However, she seemed to find discussion of text material to be quite productive. A student who was assigned to the structured learning cell procedure stated that the behavior modification strategy that was suggested in the "structured" guidelines did not work because she and her partner could not find anything in their behavior that they wanted to change. In general, it appears as if most students tended to stick with the same kind of learning cell activities for each unit. If their initial activities were ineffective, learners tended to drop out of the learning cell, and vice versa.

### Case Studies

Two case studies are presented in order to illustrate some of the distinctive features of the learning cell as it operated within a natural educational environment. The first case study involves a dyad that appears to have had many of the characteristics of a successful learning cell (Kingsbury, 1968; Goldschmid, 1971; Schermerhorn, 1971; Alexander, et al., submitted for publication). The second case study involves a set of dyadic relationships that are more difficult to categorize. The dyad in the first case study was a "viable" learning cell for each of the last three instructional units; i.e., for each of these units at least one Activities Log was received from a dyad member, at least one Unit Mastery Evaluation was taken by a dyad member, and only the same individuals worked together for these units. In contrast, the second case study involves four learners, two of whom participated in two different dyads during the term.

Both case studies are derived from relatively large and fairly complete sets of data; this is one reason why they were selected for special consideration in the present investigation. However, a more important factor in their selection was their potential as sources for understanding some of the seemingly more critical features of the learning cell. The first case study presents an example of a productive mutual learning and teaching

relationship and, as such, allows the investigator to focus on positive examples of important features in the learning cell. The second case study, however, considers a set of dyadic relationships and activities that were somewhat less academically productive. Case study #2 is not a true counter-example of a learning cell, instead it illustrates a series of learning relationships that have both their good and bad points. The investigation of a dyadic learning situation that was neither a clear failure nor a clear success allows one to assess the relative contribution of various factors in the relationship, and perhaps, thus attain greater insight into the critical features that characterize its operation. The second case study was selected on this basis.

These two case studies should not be viewed as complete descriptions of the learning situations that existed for these sets of learners. For the most part, both studies are post hoc examinations based on data collected as part of the experimental phase of the overall project. Thus, no information of an ongoing observational nature is considered. Much of the data were collected in personal interviews with the "primary," i.e., randomly selected, member of the dyad, although the Activities Logs of each participant also provided useful information concerning the operation of the learning encounter. Supplemental information was derived from student records,

course records, and student responses on measurement instruments that were employed in the experimental phase of the overall project.

#### Case Study #1

This learning cell was one of the more successful dyads that participated in the overall study. Both members performed well on all Unit Mastery Evaluations and had mutually favorable comments about their joint study endeavors.

The "primary" member of this learning cell, i.e., that individual who was randomly selected for participation in the overall research investigation, was a single male physical science major; he was in a dual enrollment program with the College of Education. Brian was a senior and an upper division candidate for a provisional teaching certificate. He had a 2.75 grade point average at Michigan State University.

Otto, the other member of this learning cell, was a single male secondary education and curriculum major. He, like his partner, was an upper division candidate for a provisional teaching certificate. Otto was a junior and had a 3.06 grade point average at Michigan State.

Both men were members of the same Interpersonal Process Laboratory and had talked together before Brian asked Otto to work with him in the learning cell.

Brian indicated that his selection was based on the perception that Otto would be both a good influence on him and a good worker. Brian further indicated that Otto was his first choice for a partner, although he felt that he probably would have had a good experience with most potential partners. Brian also mentioned that he liked the opportunity to choose who worked with him in the learning cell.

With the exception of Unit I, in which the learning cell members worked independently, both men attained mastery on the first trial of every Unit Mastery Evaluation taken after they had worked together in the learning cell. Brian took the Unit I Evaluation twenty-three days after classes began and passed it on the first trial. Otto, however, waited twelve additional days before taking the Unit I Evaluation and passed the exam on the second trial after undergoing reinstruction in the carrel testing room. Within three days, both men had studied together in their learning cell for the first time and then successfully passed the Unit II Mastery Evaluation on the first trial. Two weeks later both men finished the course, each passing the exams for Unit III and Unit IV on the first trial. For these last three instructional units, the dyad members maintained similar rates of unit completion and both finished the course two full weeks before the end of the term.

Partners reported different dates for their learning cell session on Unit II. It seems likely that the session took place on the day that Otto took the Unit I Evaluation since Brian reported this date in his Activities Log and the date that Otto reported was seven days before he first took the Unit I Evaluation. If this interpretation is correct, both members of the learning cell successfully passed the Unit II Evaluation within three days of the study session; Otto passed the exam one day earlier than Brian.

The learning cell session for Unit III took place in the carrel room on the same day that both men passed the Unit III Mastery Evaluation. During the next nine days, both men worked in their learning cell on three different days in the carrel room, finally completing the Unit IV Mastery Evaluation after this last session.

Although there is a risk of over-generalizing, the sequence of study sessions and testing that this learning cell followed seems to indicate that there was a progressive increase in learning cell efficiency. It appears as though Brian had to wait for Otto to finish Unit I before they could begin to work in their learning cell. Although Brian did not mention this specifically, he did indicate that one of the biggest problems he experienced was arranging mutual hours with his partner and he also stated that he did not want to force his partner to

keep up with him. However, after this early delay, both men seemed to maintain the same study pace for the rest of the term. As they progressed through each unit of instruction, dyad members also began to utilize their learning cell as a review session just before taking the examination. Upon reaching Unit IV, the number of learning cell sessions had increased to three, a possible indication that both members were finding the learning cell to be a useful approach for learning unit content. However, it should be noted that Unit IV contains relatively difficult material, six principles of learning, thus dyad members may have simply decided to space out their coverage of the topic into three distinct sessions.

The efforts of dyad members to maintain the same study pace seems to suggest that there was an element of concern about not holding up one's partner. The efforts to maintain similar study paces may also indicate a commitment to hold up one's own part in the joint endeavor, an example of the need to reciprocate (Bruner, 1968), in this instance, an indirect attempt to make a useful contribution to the partner's learning.

There were several indications of "generalized reciprocity," (Sahlins, 1965), i.e., an actor giving assistance and, if possible or necessary, receiving assistance in return. Dyad members consistently indicated on their Activities Logs (Otto did not submit one for Unit IV) for

learning cell sessions that their partner was willing to spend time making sure that the other partner understood the material and that the partner was, in fact, able to explain the material in such a way that it could be readily understood. In addition, dyad members also felt that they themselves were able to make a useful contribution to their partner's mastery of the unit objectives.

Dyad members consistently felt that their partners were adequately prepared for the learning cell sessions. Their partner's reports of the time spent on advance preparation for the sessions tend to support this belief. With the exception of Brian's report on his Unit IV Activities Log that he did not prepare in advance for those last three study sessions, the minimum amount of time devoted to advance preparation for a learning cell sessions was 60 minutes. The maximum time reported was 300 minutes. Initially, Brian tended to spend two to five times longer than Otto in advance preparation.

Both members of the learning cell utilized the text in preparation for their joint learning sessions. Otto tended to skim the text, take the pretests, and study the mini-lessons in the text. For Unit II, Brian reported similar preparations, although he read the text thoroughly instead of skimming it. This probably explains why Brian spent so much time in advance preparation for this unit, 300 minutes. Brian switched to a skimming



strategy for Unit III, and beginning with this unit of instruction, his preparation activities closely approximated those of Otto. Both men also began to utilize their Interpersonal Process Laboratory instructor's notes in their preparations for learning cell meetings. As noted earlier, Brian reported no advance preparation for Unit IV; Otto did not turn in an Activities Log for that particular unit.

Although there was no evidence of advance preparation on Unit IV materials, it is noteworthy that this was also the only unit in which the learning cell met on three different occasions. As in previous units of study, these learning cell meetings took place in the carrel room where these particular dyad members spent a great deal of their learning cell session watching instructional films and slides. Brian reported that he and Otto consistently went through the carrels together, and that this was the learning cell activity that seemed to work best. He remarked that this joint endeavor was valuable in that each member would see different things in the films and thus it was easier to recall examples from the films that illustrated the concepts under consideration. He felt that more information and different viewpoints were presented when the two of them worked together on the films, an observation which is consistent with expectations generated by Moore and Anderson's (1969)

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"perspectives principle." It is also interesting to note that this learning cell was practically the only viable dyad to use carrel films or slides and, in addition, this was one of the few viable dyads to conduct their joint sessions in the carrel room.

Otto and Brian did not always agree in their reports concerning other, additional activities pursued in their learning cell. However, it appears as though a relatively large amount of time was devoted to resolution of questions on unit material and pretests. Both members consistently reported discussions of situations in which unit content could be applied; often they used personal examples to illustrate these applications. As the term progressed, dyad members began to share notes with one another on unit material.

In addition to the advantages of considering the subject matter from different perspectives and filling in missing gaps, Brian noted that another feature he liked about the learning cell arrangement was the opportunity to get feedback from his partner. He felt that both the criticisms and reinforcement that his ideas received were quite helpful. Otto also rated the sessions as being quite helpful; he indicated that he found each learning cell session to be fun as well.

Otto and Brian appeared to encounter few problems in working together. Both men were off-campus students

and seemed to enjoy the opportunity to make regular contact for study sessions. It is interesting to note that another learning cell composed of off-campus students also proved to be highly successful, even though the "primary" partner expressed serious reservations about his ability to participate when the study was first discussed with him.

One difficulty that Otto and Brian experienced in meeting together was that of finding mutual free time, but they rated this as a minor problem and only reported it for one study session. The biggest problem with the learning cell arrangement appeared to be an initial uncomfortableness in working with a new person, not only in terms of arranging hours, but also in expressing oneself to his partner. Brian considered this to be a normal reaction; one that required a little extra effort to overcome. He acknowledged that, in some cases, personality conflicts and different schedules could hamper the effectiveness of a learning cell, but he did not see these as problems for Otto and himself.

Very few things seemed to go wrong in this learning cell. At the end of the term the dyad worked much faster than previously, and this pace caused Otto and Brian to sacrifice their relationship somewhat, but once again, this was only a minor problem. What really appears to have been sacrificed during Unit IV because of time

pressures was the freedom to go off on tangents in their discussions. Both dyad members had common interests in religion and evidently derived great satisfaction from their interpersonal interactions on this topic. These religious discussions seemed to be rather philosophical in nature and this orientation apparently transferred to the course content as well for Otto and Brian also devoted much of their time sharing philosophical viewpoints on education.

Given the objectives and options available in the course, dyad members appeared to structure their learning activities quite effectively, an outcome consistent with the predictions of Shulman (1970) and Mager (1961). Even though they participated in a mutual learning endeavor, both partners seemed to retain their individuality. Each used different study techniques; Otto liked to write out all the answers to questions posed by either the text or Brian, but Brian seemed comfortable with only discussing them. Brian remarked that he would have felt constrained if the learning cell experience had been more structured; he would not have felt free to learn in a way that was personally relevant. The unit objectives were considered to be helpful since they supplied guidelines as to where to concentrate efforts, and Brian saw value in being provided with options and alternatives. He did emphasize, however, that he would be more likely to do these things

if he had a chance to decide for himself; he did not want to be told what to do. He noted that structured activities were primarily of benefit to procrastinating learners.

Although Brian and Otto did not follow the set of structured learning procedures that constituted the treatment to which they were assigned (Brian forgot to pick up his packet of instructions when he turned in the Unit I Mastery Evaluation), Brian felt that he probably would have tried it since he saw value in practicing the concepts in real situations. He expressed the feeling that the course material was easy to learn, but was not designed well enough for practical application. Brian doubted if even 25% of the students in the course would actually use "The Process Model" in their teaching since the concepts were difficult to remember. He thought that many learners would have remembered the material better if they had had an opportunity to try out these concepts on peers or other students.

The general reaction to the learning cell experience was quite positive. Given no personality conflicts, Brian saw few limitations on the applicability of the learning cell as an instructional strategy. He felt that learning cells could be formed between professional teaching colleagues in which resources and experiences could be both shared and explored. He further noted that learning cells could also be formed between classroom

teachers and their students to produce a situation where the teacher could learn as well as the students.

Both learners appeared to have enjoyed their experiences in "The Task Demands of Teaching" phase of the course, as well as in the Interpersonal Process Laboratory. Although Brian did not find the two phases of the course to be closely related, contrary to what one might expect, his reports of learning cell sessions seemed to demonstrate that many interpersonal communication skills were successfully employed by both Otto and himself, e.g., honesty, openness, active listening, respect for oneself and others, constructive use of feedback. Both men seemed to have done well in each phase of the course, but it is difficult to say which of the two they enjoyed the most. Otto indicated that the carrels contributed more to his thinking about education, a possible reflection of his positive evaluation of the learning cell experience, but he also had very positive feelings in regard to the overall course. He felt that the course intensified his desire to teach, and also contributed to his ability to teach. He considered it to be better than most courses that he had taken at the University.

The success of this learning cell could be attributed to a number of factors. The interpersonal relationship between cell members, based on similar interests, is

particularly salient. A sense of reciprocity, a commitment to one's partner's learning, is evident as well. The consistent utilization of film and slide-tape instructional materials was a practice that appears to have been quite successful and one which seemed to capitalize on the particular learning-teaching features of the learning cell, yet it was also a strategy that seemed to receive only minimal consideration by the other learning cells which participated in the investigation. This was the only learning cell in the entire study to meet more than once for the same unit of instruction, an occurrence that may suggest the value that participants saw in the learning cell approach, although it may also have been a function of the more difficult unit content or the reliance on the carrel mode of instruction. The general attitude of the "primary" partner toward learning was exceptionally positive and his tendency to view new and uncertain situations as potentially growth-producing certainly must be taken into consideration when assessing the characteristics of this particular learning cell.

### Case Study #2

The second case study focuses on four learners, rather than two, and therefore the dyadic relationships involved are somewhat more complicated than they were in

the learning cell examined in the previous case study. A series of joint learning sessions occurred between various combinations of dyads, but no single dyad remained intact for all of the instructional units offered in the course. Two learners participated in two different learning dyads; the remaining two learners began the term in learning cells, but did not continue to participate for all units. One member of this latter group of learners did not complete Units III or IV during the term and received an "incomplete" grade for "The Task Demands of Teaching" phase of the course. Another of these four learners passed that part of the course, but received an "incomplete" grade in the Interpersonal Process Laboratory. All of these events, viewed together, depict a series of learning relationships that were relatively unstable, and yet, quite complex. Although the dyads in this case study were not "viable" according to the criteria established in this overall research project, they do present data that are not only interesting, but also relevant to an understanding of learning cell dyads.

The following chart illustrates the nature of the learning relationships among Donna, Vern, Karen, and Pam, the four learners who are the subjects of this case study:

<u>Unit I</u>	<u>Unit II</u>	<u>Unit III</u>	<u>Unit IV</u>	<u>IPL</u>	<u>Total Course</u>
*Pam(1)	Pam(1)	-Pam	-Pam	Pam	-Pam
Karen(0)	Karen(0)	Karen(0)	Karen(0)	-Karen	-Karen
*Donna(0)	Donna(0)	Donna(0)	Donna(0)	Donna	Donna
Vern(1)	Vern(2)	Vern(0)	Vern(1)	Vern	Vern

("\*" indicates the "primary" learning cell member;  
 "-" indicates that the learner did not achieve mastery;  
 the number within the "()" indicates the number of  
 reinstructions required before the learner achieved  
 mastery on the unit of study; and the "]" indicates  
 the members of a functional dyad.)

As the chart indicates, the dissolution of two initial learning cells occurred before the learners began to work on the fourth and final unit of instruction. It was at this point that a member of each of these original learning cells joined together to form another learning cell. Although it is difficult to assess many of the factors that may have been involved in the breakdown of these original learning cells, this chart does provide a helpful starting point.

One pattern that is noticeable is that the two learners who did not complete the term in learning cells encountered difficulties on almost every Unit Mastery Evaluation, whereas the two learners who worked in a learning cell for each of the last three units appeared to do quite well on these examinations. Pam and Vern both required reinstruction on Unit II, but their partners did not. Pam never completed Unit III or Unit IV, and although Vern

achieved mastery on the first trial of the Unit III examination, he once again needed reinstruction on Unit IV. In contrast, Karen and Donna never needed reinstruction during the term, and it was they who eventually joined together to form a new learning cell.

One possible explanation for these differences in success on the Unit Mastery Evaluations might be that Karen and Donna were simply better students than their original learning cell partners. However, an examination of grade point averages failed to confirm this expectation. Although Donna's 3.33 grade point average for 69 credit hours was considerably better than Vern's 2.44 grade point average for 42 credit hours, Pam, who did not complete Units III and IV, had a respectable 3.02 grade point average based on 79 credit hours, and her partner, Karen, had a 2.65 grade point average for 146 credit hours.

An examination of other demographic data for each of these learners failed to suggest any plausible explanation for the differences in initial success on Unit Mastery Evaluations. Vern was a single male sophomore majoring in health, physical education, and recreation; he was enrolled in a pre-education program. His learning cell partner, Donna, was a single female sophomore who was also enrolled in a pre-education program. Donna's major, however, was in natural resources and

environmental education. Donna was the "primary" partner in this dyad, and as such, had asked Vern to participate in the mutual learning and teaching endeavor.

In the other original learning dyad, the "primary" partner was Pam, a single female sophomore enrolled in a pre-education program; Pam's academic major was in elementary and special education. Her partner, Karen, was also an elementary and special education major, and she too was unmarried. However, Karen was a senior, not a sophomore, and she was therefore enrolled in an upper division program.

Karen, Pam, Vern, and Donna were all members of the same Interpersonal Process Laboratory. Each of them had fairly positive attitudes toward their experiences in the Interpersonal Process Laboratory and all except Donna indicated that this aspect of the course contributed most to their thinking about a career in education; Donna indicated that the text made the greatest contribution for her. Karen rated the IPL experience extremely high, an interesting point in light of the fact that she was the only one of these four students who did not feel that she had adequately demonstrated the IPL learning objectives throughout the term. Karen's perception was shared by her IPL instructor as well, as indicated by the "incomplete" grade that he assigned her for this phase of the course.

The rate of study for each unit of instruction, at least for the earlier ones in which the original learning dyads were in operation, appeared to be similar for partners. Donna and Vern initially took the Unit I Evaluation within four days of each other, and actually were in a position to begin working in their learning cell sooner than Otto and Brian, who comprised the dyad in Case Study #1. However, Donna indicated at the end of the term that she wished she had begun even earlier. For Units II and III she and Vern differed by no more than one day in terms of taking Unit Mastery Evaluations.

In comparison to Karen, Pam first took the Unit I Mastery Evaluation fifteen days earlier, although both of them also took the Unit II exam on the same day that Karen completed Unit I. Their first learning cell session had taken place during the previous day. A similar pattern was evident for Unit III; Karen passed this Mastery Evaluation within one day of their learning cell meeting. However, Pam never completed this unit of study, and it was at this point that the learning cell dissolved.

Donna and Vern tended to take their Unit Mastery Evaluations within a day of their learning cell sessions, even for Unit III, the point at which this learning dyad also began to dissolve. It is surprising that this unit of instruction, Unit III, was the only one in which Vern passed the unit exam on the first trial, because one

possible hypothesis that is suggested by the data is that these two original learning cells began to break down because one partner consistently required reinstruction on a unit, thus slowing down the pace at which the learning cell could work on the units of instruction.

The data on number of reinstructions required by a learner on each unit of study are interesting for another reason as well. One of the manifestations of a "generalized reciprocal" relationship (Sahlins, 1965) would seem to be that dyad members would make special efforts to make special efforts to make sure that their partner adequately understood the material before that partner actually took a Unit Mastery Evaluation. Yet, the data indicate that one partner in each original dyad almost consistently required additional help from a course tutor before achieving mastery on unit exams, whereas the other partner rarely, if ever, consulted with a course tutor. However, it seems risky to conclude that a "generalized," or even "balanced" (Sahlins, 1965), type of reciprocity was necessarily absent in these original learning dyads. In the first place, dyad members may, in fact, be unable to accurately assess their partner's understanding of the material and merely assume that their partner's learning would be adequate for achieving unit mastery when, in reality, it was not. Secondly, there are other kinds of data which appear to

present a somewhat contradictory impression. For example, the reports of Pam and Karen concerning their learning cell activities for Units II and III seem to suggest that each of them was a contributing member of their dyad. Although Pam did not return an Activities Log for Unit III, she indicated that on Unit II, Karen was adequately prepared for their joint learning session and, in addition, she was both willing and able to explain the material in a way that was readily understandable. Pam also noted that she, herself, had been able to make a useful contribution to Karen's learning as well, a fact that was confirmed by Karen in her reports for the Unit II and Unit III sessions. Karen's perceptions were thus quite similar to those of her partner; she felt that Pam was also adequately prepared and both willing and able to appropriately explain the course material.

Given these mutually positive reports and, yet, the eventual dissolution of this learning cell, what can be said about the nature of reciprocity as manifested in the dyad? Certainly, no definite conclusions can be drawn, particularly when one considers that the reports of Otto and Brian were essentially the same as those of Pam and Karen in respect to the questions which were designed to assess the presence or absence of reciprocity. In a second, informal, brief interview, Pam indicated that the reason why she stopped working in her learning

cell was that she was simply overwhelmed by pressures in other courses and time commitments involved in her participation on the women's swimming team. Thus, she felt it was in Karen's best interests that she discontinue working in the dyad; she indicated that she did not want to prevent Karen from finishing the course by forcing Karen to wait for her. Although Pam's motive might not have been "the need to reciprocate," she appeared to manifest her concern for her partner's learning endeavors by leaving the learning cell rather than remaining in it.

Since Vern did not return any Activities Logs, this other learning cell must be examined primarily from Donna's viewpoint. The relationship between Vern and Donna provides an interesting contrast to the one between Pam and Karen. For Unit II, Donna reported that Vern was inadequately prepared for the learning cell session and that he was unable to explain the material in a way that she could understand. Although she indicated that Vern was willing to spend time with her on the material, she felt that she could have completed the unit in less time on her own. Donna did feel that she had made a useful contribution to Vern's mastery of the objectives, but remarked that she did "more explaining than studying." It appears as though Donna perceived Vern to be a "negative reciprocator" (Sahlins, 1965); i.e., she seemed to feel that he learned the course content at her expense

and made little effort to teach her anything.

Donna rated their first learning cell session as being inconvenient and a waste of time. She found their second session to be helpful, but stated, "Although I felt I knew the material already, it gave me a chance to review it." The difficulties that Donna had in meeting with Vern appeared to be primarily based on his relatively different study pace. She noted that it was hard to find a partner who could both study for and take the test on the same day. For Unit III, Donna mentioned that she had to wait three additional days beyond the time when she felt that she was adequately prepared for the test in order to study in the learning cell with Vern.

Donna reported no advance preparation for the first learning cell session and only 30 minutes for the second session; she did not mention what she actually did to prepare for this latter session. This first study session lasted for approximately two hours and occurred primarily in the hallway outside of the carrel room, although Donna also reported that some time was spent viewing films in the carrels. According to Donna, of the two hours devoted to the study session, only forty minutes were actually spent in studying together. Since there are indications that neither partner prepared in advance for the joint-study session, it seems likely that much of the remaining time was devoted to initial coverage of



the material. Their activities in reviewing the unit pretest and carrel programs seem to support this interpretation. Donna did report, however, that she and Vern asked each other questions on the material and discussed unclear points, so at least some of the study session consisted of endeavors more characteristic of learning cell activities.

Their second study session, in which they covered Unit III material, took place in Donna's room in the residence hall. Donna reported that the entire 50 minute study session was devoted to learning cell activities such as reviewing the unit pretest and self-test, sharing notes and asking each other questions on the unit material, and discussing possible applications for the unit content. Donna noted that in their learning cell it was unproductive to take the pretest initially. A more useful strategy seemed to involve a quick scan of the pretest, study of the concepts, and then completion of the pretest. Some of this difficulty is probably attributable to the relatively small amount of advance preparation for this session.

Pam and Karen conducted their two study sessions in dormitory rooms and lounges. Advanced preparation for these sessions ranged in duration from one to two hours and primarily consisted of looking over the text with most of the attention focused upon consideration of

examples, concept definitions, and pretest items. The Unit II session lasted for 45 minutes, but the session for Unit III was extended to an hour and 40 minutes. However, only 60 minutes of this latter session was devoted to actual study, whereas the first session totally consisted of actual study. During this second session time was spent in reading over the text in addition to other activities which were also pursued in the first session: asking questions on the unit content; reviewing the pretest; and discussing unclear points in the material. In addition, during this Unit III session, Pam and Karen considered ways in which the course content could be applied to real situations. Both Pam and Karen seemed to find these sessions to be helpful and fun, but they also found them to be inconvenient, primarily because of difficulties in arranging schedules.

Most of the dyads which participated in this investigation also rated scheduling as being the biggest problem with the learning cell approach. Pam and Donna noted that it was difficult to find mutually convenient study times. In addition, Pam mentioned that there were occasional transportation problems involved and that it was not always easy for students to maintain similar paces in their study of the material, circumstances which also seemed to militate against working together in learning cells. Even for Unit IV, in which Karen and

Donna seemed to successfully work together, Donna noted that, "Pam had to pick me up and drive me home because it was raining, and I didn't like inconveniencing her."

With the exception of this one problem, the study session with the new partners appears to have been quite successful. The meeting occurred in Karen's apartment and lasted for two hours, an hour and a half of which was actually spent in studying together. Donna spent 10 minutes looking over the important concepts in advance preparation; Karen did not submit an Activities Log for Unit IV so specific information on her preparation efforts is missing. Donna rated the session as being both helpful and fun. Donna also felt that Karen was adequately prepared for the session and that she was also both willing and able to explain the course material. However, Donna seemed uncertain as to whether or not she, herself, was able to make a useful contribution to Karen's mastery of the course objectives even though the two of them asked each other questions on the content, reviewed the unit pretest and self-tests, and discussed applications for the material as well as unclear points. Some time was also devoted to reading over the text.

Donna evidently enjoyed working with Karen much more than she did with Vern. She seemed to feel that she and Karen approached the material on a more equable basis and their interpersonal relationship seemed to be

much better. Donna stated that Vern looked to her as a teacher; she felt as though she were there to help him. Donna felt that she was able to find a way to teach Vern, primarily by explaining concepts, having Vern explain them back to her, and by reviewing self-tests with him. Although these activities made her review the material and remember it better by having to repeat it, Donna seemed to feel that she had learned nothing new in the process.

In contrast, when Donna worked with Karen they both contributed ideas to their discussions of unit concepts. Karen seemed to be particularly good at relating these concepts to personal experiences. Donna also noted that Karen was well prepared for the study session, whereas Vern only skimmed over the material beforehand. Donna stated that Karen was someone she liked and she had fun working with her.

When asked about what would keep people from effectively working in dyads, Donna said that a partner's unwillingness to get something out of the experience was probably the biggest hindrance. She indicated that partners needed to be open to both learning and teaching; they needed to have a positive attitude about helping another to learn as well as a willingness to be helped by another. It was important for partners to be very patient in order to effectively perform both teacher and

learner roles. Donna also felt that successful dyadic study was facilitated when partners were on the same knowledge level and she indicated that advance preparation by both partners was also important.

Pam also felt that partners must be open-minded and interested in learning the material in order to produce effective studying in dyads. Although it seemed important to work with someone who was a good teacher, Pam also expressed the belief that the partner should be someone who was not too well known so that they would not tend to get off of the topic.

The most successful activity for Pam and Karen involved asking each other questions about the concepts and providing explanations for them. Pam indicated that the dyadic learning-teaching experience helped to clarify these concepts and provided an opportunity to practice using them. Donna had a similar reaction, suggesting that the experience helped her remember the material since it forced her to review it verbally. Donna also noted that the dyadic learning-teaching experience required her to concentrate more on the material because there was an incentive to stay with the task until both of them knew the material. Pam felt that the pressure to keep up with one's partner was one of the most valuable features of the learning cell approach.

The dyads in Case Study #2 were in the unstructured

learning cell treatment, yet several of these participants expressed the feeling that the experience could have been somewhat more structured in order to improve the opportunities for effective learning. Donna would have liked to have had partners assigned for the whole term and also certain times designated for study sessions, two suggestions that seem to be related to the major problems she encountered in her experiences with dyadic learning. She suggested that advance warning of pitfalls such as these would have been quite helpful. Yet, Donna also emphasized that partners should have responsibility for choosing their study methods and determining what they did during the study session.

Pam felt that the learning cell experience should have been offered only on a voluntary basis. She stated that people who knew that they had time to take part would be more committed to working in the project. Donna's feelings about her participation were somewhat similar to Pam's. She did not feel very dedicated to the project; she just wanted to get it done.

Donna also noted that she enjoyed the conversational style of the text and found the pretests and self-tests to be quite helpful. It seemed easy enough to learn the material on her own, and thus she felt that there was no real need to work with another learner on the material.

Participants tended to see the learning cell approach as being a useful strategy for most learning situations, especially in courses in which the content was amenable to creative discussion by learners. Donna cautioned against using the learning cell in technically-oriented courses where the dangers of giving and receiving misinformation seemed to be particularly problematic. On the professional level, the learning cell was also seen as a means of keeping up to date in one's subject area, perhaps as a preparatory activity for formal team-teaching in the classroom.

In summary, the results of this case study suggest that mutual learning and mutual teaching are critical elements for successful learning cell operations. Adequate preparation, similar rates of study, active dialogue and good interpersonal relationships appear to facilitate these processes.

## CHAPTER V

### SUMMARY AND CONCLUSIONS

The first part of this chapter presents a general summary of the study. The second part presents conclusions that may be drawn from the results.

#### Summary

The primary objective of this study was to design, implement, and evaluate a peer-based instructional strategy involving dyads of learners working together in an ongoing, competency-based, introductory level teacher education course. This peer-based instructional strategy, the learning cell, was defined as a dyadic unit in which learners mutually teach and mutually learn from each other.

Specific contributions to the literature on the learning cell were considered and then compared with the more general literature on peer-instruction in terms of provisions for active learning and teaching. Review of these peer instructional systems indicated that even though peer dyad learning procedures had been successfully employed across a relatively wide range of subject

matter areas, their use within the field of teacher education had been limited. In addition, there was no evidence that a true learning cell procedure had been employed in a course based upon a mastery learning model. The examination of the literature also revealed arguments for and against learner-controlled instruction. Consideration of the advantages and disadvantages of field experiments suggested the potential value of conducting learning cell research in relatively natural educational settings.

The addition of the learning cell approach to "The Task Demands of Teaching" phase of The Individual and the School course was generally expected to produce the following outcomes: (1) effective learning; (2) alleviation of course administrative difficulties; and (3) improvement of student perceptions of the course.

The original experimental design had three levels of the independent variable, learning procedure: (1) structured learning cell; (2) unstructured learning cell; and (3) control group. The procedures for the structured learning cell were designed by the investigator; procedures for the unstructured learning cell were determined by each dyad. The control group consisted of students who pursued the usual self-instructional options offered by the course. However, an unexpectedly large loss of experimental subjects resulted in a modified

design that primarily consisted of two treatment groups, one composed of viable learning cells, and the other composed of non-viable learning cells. A "viable" dyad for a particular unit of study was defined as one in which at least one report (Activities Log) of a learning cell meeting was received from a dyad, a Unit Mastery Evaluation was taken by at least one dyad member, and only the same individuals worked together in the learning cell during the term.

Twelve specific hypotheses concerning these general expectations were formulated and tested by either a univariate analysis of variance or chi-square test for homogeneity of proportions. Results indicated no significant differences ( $\alpha = .05$ ) between treatment groups on any of the dependent measures.

In addition to these experimental hypotheses, a number of general research questions were designed to serve as an organizational framework for the investigation and subsequent reporting of the characteristics of learning cells and the processes that occur within them. Two case studies were also conducted in order to provide insights into the nature of peer teaching strategies.

Results of these descriptive investigations suggested that mutual learning and mutual teaching are critical elements for successful learning cell operations. The importance of adequate preparation, similar study

rates, active learning, and shared responsibility was evident as well.

### Conclusions

Several conclusions can be drawn from the results of this investigation, particularly with respect to the cognitive level of the learning tasks that are appropriate for learning cell strategies and the degree to which learning cell activities are structured. .

It had been expected that the addition of a greater degree of interpersonal interaction, in the form of the learning cell, could produce even more effective learning, reduce administrative problems, and also improve student attitudes in an introductory teacher education course. This investigation did not indicate that these expectations were realized. Why not? One plausible explanation is that the cognitive level of the course objectives was not appropriate for the learning cell procedure to work effectively. The essential dynamics of the learning cell are mutual teaching and mutual learning. Yet, in retrospect, the objectives of the course appear to have only required cognitive skills such as knowledge, comprehension, and application (Bloom, 1956). Mutual teaching and mutual learning may be possible only for subject matter involving higher levels of complexity such as analysis, synthesis, and evaluation. Perhaps it

is only at these levels that effective discussion can occur.

Data collected in this investigation strongly support this contention. A number of students stated that they did not follow the learning cell format because the material was already well presented and easy to learn. Many of these students indicated that it was a waste of time for them to go over the material with another student because they already knew it well enough after studying on their own to pass the Mastery Evaluation. The relatively large amount of non-participation by students assigned to learning cell treatments may be regarded as further evidence of this feeling among many of the students.

Mager's (1961) research on learner-generated instructional sequences provided the primary rationale for the design of the unstructured learning cell treatment that was employed in this investigation. Yet, ironically, his conclusion may also provide the rationale for the "non-treatments" which were manifested:

...if an adult learner has been provided with behaviorally stated objectives, and with control over his learning, he will reach the objectives by dovetailing what he needs to know with what he already knows. (p. 412)

In the present investigation, it appears as though at least several learners did just that--examined the behavioral objectives for the course, studied the material by

themselves, decided that additional discussion of the material in a learning cell was unnecessary, and then controlled their learning by not participating in a learning cell. Learning cell activities may have fared much better if the subject matter had been such that discussion was essential for learning the material.

The problem of how to effectively structure learning cell activities has not been adequately resolved. The learning cells which participated in this study seemed to prefer the freedom to study the materials as they wished. However, three of the main difficulties that these learners experienced, finding a partner, finding the time and place for learning cell meetings, and studying unit modules at a pace similar to that of one's partner, may be eliminated if the teacher-manager assumes responsibility for them. This suggests that the learning cell may be most effectively employed in the classroom, where these conditions can be controlled.

The learning cell appears to be an extremely effective instructional strategy when it is appropriately managed and employed with prudence. The nature of the learning task and the way in which the strategy is structured are critical considerations.

## **APPENDIX A**

### **Reactionnaire for Unit III**

**Directions:** Please fill in your student number and code it in the box at the right. Then respond to the items below by marking the appropriate blank indicated by the arrow. Please respond:

1 = STRONGLY AGREE; 2 = AGREE; 3 = NEUTRAL; 4 = DISAGREE;

5 = STRONGLY DISAGREE.

STUDENT NUMBER	

1. This instruction helped me understand the task of goal setting-----▶
2. The film in the Goal Setting Unit (seen in the carrel) helped me to identify knowledge and skill needed by teachers-----▶
3. I think that further training in how to effectively perform goal setting would help me become a better teacher-----▶
4. The materials presented in this unit were well organized-----▶
5. The materials presented too many concepts at one time (i.e., there was too much for me to understand)-----▶
6. The instructional materials provided enough examples and detail to satisfactorily explain the concepts-----▶
7. The concepts were presented in a manner which held my interest-----▶
8. In studying the Goal Setting Unit, I was able to consider the use of goal setting in a variety of situations and contexts-----▶
9. I was able to exercise an appropriate amount of personal control over the way in which I studied the Goal Setting Unit-----▶
10. Behavioral objectives are something that I really understand-----▶
11. After studying the Goal Setting Unit, I felt that I was prepared for the mastery evaluation-----▶
12. The instruction helped me understand the process of teaching-----▶
13. Teachers should use behavioral objectives in their instruction-----▶
14. I plan to use behavioral objectives in my instruction-----▶
15. I feel that I could perform the task of goal setting without any further instruction-----▶

## **APPENDIX B**

### **Activities Log**

11

Unit Studied \_\_\_\_\_

Study Session # \_\_\_\_\_

ACTIVITIES LOG

Your name \_\_\_\_\_ Your partner's name \_\_\_\_\_

Date, Place And Time Of Study Session With Your Partner:

1. Date: \_\_\_\_\_
2. Place(s): \_\_\_\_\_
3. Hours during which your study session took place: \_\_\_\_\_ AM/PM  
to \_\_\_\_\_ AM/PM.
4. Your estimate of the amount of time actually spent on studying together:  
\_\_\_\_\_ minutes.
5. Your estimate of how long you had to wait for your partner to arrive for the  
study session \_\_\_\_\_ (minutes) or your estimate of how late you  
were in arriving for the study session \_\_\_\_\_ (minutes).

Preparation for Study Session:

1. How much time did you spend in advance preparation (by yourself) for the  
study session with your partner? \_\_\_\_\_ minutes
2. If you did prepare in advance for the study session what materials did you  
use and what did you do with them?

The Study Session:

1. What did you and your partner do together during this study session? (you  
may check more than one)  
\_\_\_\_\_ read over the text  
\_\_\_\_\_ watched films or slides in the carrel room  
\_\_\_\_\_ asked each other questions on the material in the unit  
\_\_\_\_\_ reviewed the unit pretest or unit self-test  
\_\_\_\_\_ shared notes on the material in the unit  
\_\_\_\_\_ discussed situations in which the material in the unit could be applied  
\_\_\_\_\_ reviewed materials related to the unit that were not provided by the  
course, that is, outside readings  
\_\_\_\_\_ discussed points in the materials that were unclear to either you or  
your partner  
\_\_\_\_\_ other, please specify:  
\_\_\_\_\_
2. Did you and your partner study any other academic subject together besides  
Education 200 during this study session? \_\_\_\_\_ yes \_\_\_\_\_ no

3. Please list any difficulties you had in meeting with your partner for the study session:
4. Do you feel that your partner was adequately prepared for the study session?  
\_\_\_\_\_ yes \_\_\_\_\_ no
5. Do you feel that your partner was willing to spend time making sure that you understood the material? \_\_\_\_\_ yes \_\_\_\_\_ no
6. Did you feel that your partner was able to explain the material in a way that you could readily understand it? \_\_\_\_\_ yes \_\_\_\_\_ no
7. Do you feel that you were able to make a useful contribution to your partner's mastery of the unit objectives? \_\_\_\_\_ yes \_\_\_\_\_ no
8. How would you rate the study session? (you may check more than one)
- \_\_\_\_\_ helpful  
\_\_\_\_\_ a waste of time  
\_\_\_\_\_ fun  
\_\_\_\_\_ inconvenient  
\_\_\_\_\_ boring  
\_\_\_\_\_ challenging

TURN IN COMPLETED FORM TO DESIGNATED BOX IN 130 ERICKSON HALL!

## APPENDIX C

End-Term Evaluation,  
Parts I, II, and III

Part I

Please indicate your reaction to the following questions using the scale below:

1. Definitely
2. Very likely
3. Unsure
4. Not very likely
5. Definitely not

1. Retrospectively (knowing what you know now), if the IPL experience was not required, would you choose to take it?
2. If an advanced IPL experience was given on an elective basis and you were eligible to take it, would you?
3. If you were offered an opportunity to participate in another small group experience outside of Education 200, would you join?

Part II - Examinations and Grading, Tutorials, Carrels

4. Did you find that the examinations adequately tested the material presented in the course?
  1. Yes
  2. Undecided
  3. No
5. Did you feel that the "Pass-Incomplete" grading system based on mastery tests was fair?
  1. Yes
  2. Undecided
  3. No
6. How did you perceive the subject matter competency of the tutors doing the reinstructing?
  1. Below average
  2. Average
  3. Above average

7. How do you feel about the testing-tutorial system used in ED 200?

VERY UNFAVORABLE

1

2

3

4

VERY FAVORABLE

5

8. How many of the carrels did you take?

1. All of them
2. 7 - 8
3. 4 - 6
4. 1 - 3
5. None

Part III - Course Overall

9. Did Education 200 affect your desire to teach?
1. Yes, my desire to teach is more intense
  2. No, it had no effect on my desire to teach
  3. Yes, my desire to teach is weakened
10. Do you think the course will contribute to your ability to teach?
1. Yes, it will increase my ability to teach
  2. No, it will not affect my ability to teach
  3. Yes, it will decrease my ability to teach

NOTE: If you report a decrease in ability to teach, please explain on the back of the response sheet.

11. Compare this course with others you have taken at MSU.
1. Better than most
  2. About average
  3. Worse than most
12. Which aspect of the course contributed most to your thinking about a career in education?
1. Carrels
  2. IPL
  3. Lectures
  4. Texts
  5. Testing - Reinstruction Process

## APPENDIX D

### Structured Learning Cell Procedures

## GENERAL PROCEDURES

The study materials and procedures in this packet have been designed in such a way that two learners can use them in studying course material together. Therefore, it is essential that you have a partner before you begin to work with these materials. It is also necessary that neither you nor your partner have been enrolled in Education 200: The Individual and the School before this term.

The materials in this packet and the procedures for utilizing them apply to the following three (3) units of instruction: Unit II: The Process of Assessment, Unit III: The Process of Goal Setting, and Unit IV: The Process of Strategy Selection. Before you and your partner begin to study these last three units, make sure that each of you has achieved mastery on Unit I: An Introduction To Teaching.

### Study Procedures For Unit II: The Process of Assessment

(1) Before you and your partner actually meet for a study session each of you should individually go over the material for Unit II and prepare a list of points which seem unclear. In addition, write at least one question on the material to ask your partner. This question should be designed to check your partner's understanding of at least one point in the material that you feel is important.

(2) Bring your list of unclear points in the material and your written question to the study session with your partner. Begin the session by going through each partner's list of unclear points and resolve them until the two of you reach mutual agreement on all items. Then take turns asking the questions until both of you agree on an answer.

(3) When you and your partner have clarified the unit material and answered the questions to your mutual satisfaction, identify something that you can teach your partner, and identify something that your partner can teach you. They must be things that will provide an opportunity for each of you to practice working with the tasks of teaching, that is, assessment, goal setting, strategy selection, and evaluation. That which is to be taught by one partner and learned by the other partner need not be very complex -- the intention is to provide each of you with a mini-experience in employing the tasks of teaching. Some examples of things that might be done are: developing an Interpersonal Process Laboratory skill such as the giving and receiving of constructive feedback, or eliminating a bad habit, or understanding a particular concept. Of course, there are many other things that might be taught. What is taught is not of primary importance -- the emphasis should be on improving the nature of the interaction with your partner. For this particular unit, the Process of Assessment, the person taking the teacher's role must make an assessment of his or her partner's prerequisite entry behaviors as they occur in relation

-2-

to the topic to be taught. This assessment should be made according to the procedures and standards discussed in Unit II: The Process of Assessment. After the partner who is assuming the teacher's role has made an assessment of the other's skill, check out the quality of the assessment - did the person in the teacher role make an accurate assessment?, did this person follow all the necessary procedures?, etc. When this has been done, reverse roles and repeat the procedure in relation to the other topic to be taught.

(4) After you and your partner have each practiced the assessment task, feel free to pursue any other study activities that you agree upon. At the end of the study session, or soon thereafter, each of you should fill out a copy of the Activities Log which seeks to find out your impressions of the study session. Often two people may have different perceptions of the study session, so it is important that each of you fill out the Activities Log separately. Your frank and honest responses to this Activities Log is essential if improvements in the course are to be made. Additional Activities Logs have been provided so that you and your partner can record any additional study sessions you might have together for a particular unit of study.

(5) Finally, you and your partner should each turn in your Activities Log at the main desk in Room 130 Erickson Hall. Please follow this general procedure for all three units of study. It would probably be easiest to turn in these materials at the time you come to Room 130 to take the Mastery Evaluation for that particular unit.

### Study Procedures for Unit III: The Process of Goal Setting

(1) The procedures are essentially the same as those detailed in the previous unit, that is, each partner reviews the unit material, makes a list of points in the material that are unclear, writes at least one question and then brings these items to the study session. Once more, partners should continue to work together until they attain mutual agreement on answers and points related to the material.

(2) Partners should return to the teaching topics that were selected in their session(s) on Unit II, and this time proceed to take turns practicing the process of goal setting according to the procedures and standards established in the Goal Setting Unit. As in Unit II, consider the quality of the goal setting activities, and then reverse roles and follow the same procedures for the other topic that was previously being taught. After this, feel free to study anything else that both you and your partner agree upon. Then complete the Activities Log and turn it in at the main desk in 130 Erickson Hall.

### Study Procedures for Unit IV: The Process of Strategy Selection

(1) The procedures are essentially the same as those for Units II and III. After partners attain mutual agreement on answers and points related to

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the material, take turns working with various strategies discussed in Unit IV: The Process of Strategy Selection. Consider the quality of the strategy-related activities and then reverse roles as in the other units. Complete the Activities Log and turn it in at 130 Erickson Hall.

After you complete this last unit, i.e., Unit IV, there will be a questionnaire for you to fill out concerning your perceptions of your study of the materials on the various units. You are encouraged to be as open and honest as possible in responding to this questionnaire. Appropriate changes in the course will be made on the basis of the information you provide. Please remember that your participation in this study will not affect your grade in the course in any way. The criterion for completing the course is the same for every student enrolled in the course - mastery of the course objectives for each of the four units of instruction.

If you have any questions, please don't hesitate to contact any of us at the following places:

Room 130 Erickson Hall  
Phone: 353-8765  
Marian or Jane

or

Room 201 Erickson Hall  
Phone: 355-1741  
Bob Stone  
Home phone: 351-0740

Thanks again for your assistance in improving the course!

## APPENDIX F

### Control Group Procedures

## GENERAL PROCEDURES

The study materials and procedures that are available to you in this course have been designed for auto-instruction, that is, you can study the materials by yourself in preparing for each of the unit mastery evaluations. However, certain supplementary study materials and procedures will be provided for your personal use during the term. These supplementary materials apply to the following three (3) units of instruction: Unit II: The Process of Assessment, Unit III: The Process of Goal Setting, and Unit IV: The Process of Strategy Selection. Before you begin to study these last three units, make sure that you have achieved mastery of Unit I: An Introduction To Teaching.

The supplementary materials consist of articles that expand somewhat on the standard materials and services commonly available in the course, that is, the textbook, films and slide-tapes, and tutorial assistance. The supplementary articles are not required reading; they are simply available for your consideration.

The supplementary materials may be grouped into the following categories:  
Unit II: The Process of Assessment

1. "Evaluating the Schooling of Intelligence" - Paul A. Lohnes
2. "Student Social Class and Teacher Expectations: The Self-fulfilling Prophecy in Ghetto Education"- Ray C. Rist

Unit III: The Process of Goal Setting

1. "Must We Educate?" - Carl Bereiter
2. "Student Values as Educational Objectives" - Michael Scriven

Unit IV: The Process of Strategy Selection

1. "Teaching Science in High School -- What is Wrong?" - B. F. Skinner
2. "Little Brother Is Changing You" - Farnum Gray, Paul S. Graubard, and Harry Rosenberg.

Please feel free to check out any of these articles at any time during the term. They will be on loan at the main desk in 130 Erickson Hall.

After you complete the last unit, i.e., Unit IV, there will be a questionnaire for you to fill out concerning your perceptions of your study of the materials on the various units. You are encouraged to be as open and honest as possible in responding to this questionnaire. Appropriate changes in the course will be made on the basis of the information you provide. Please remember that your participation in this study will not affect your grade in the course in any way. The criterion for completing the course is the same for every student enrolled in the course - mastery of the course objectives for each of the four units of instruction.

-2-

If you have any questions, please don't hesitate to contact any of us at the following places:

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Thanks again for your assistance in improving the course!

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