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ABSTRACT

The paper encourages the establishment of university-based clinics for the diagnosis and remediation of children's learning problems in mathematics and describes the operation of such a clinic at Arizona State University. Mathematics clinics are seen to serve two purposes: helping individual children overcome their special mathematics learning difficulties, and training teacher/specialists in clinical techniques of diagnosis and remediation. Few teacher education institutions are thought to adequately prepare teachers to deal with learning problems in mathematics, though statistics show that up to 35% of elementary school students are underachieving in mathematics. Among the purposes of the Arizona clinic are devising instructional materials appropriate for training teacher/specialists and developing theoretical models and procedures for diagnosis and remediation. The clinic's student clinicians and professional personnel provide diagnosis and implement remedial work for school children clinical operations are integrated with a graduate course which focuses on diagnostic-prescriptive procedures in school mathematics. A chart shows mathematics learning center operations over a 21-week period from preliminary publicity through the final exam. (DB)

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So Johnny Can't Add -- Help from the University

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In the future of David Krech (1969), education will be much less an art and much more a science.

> "The development of the mind of the child will come to rest in the knowledge and skills of the biochemist, the pharmacologist, and neurologist, and psychologist, and educator. And there will be a new expert abroad in the land--the psychoneurobiochemeducator [p. 374]."

For this new breed of educator, the child unable to master basic number facts, for example, may be prescribed chemical memory consolidators or learning stimulants.

Fortunately or unfortunately, the technology necessary for Krech's multi-hybrid expert has not yet been developed. At present, education is more an art than a science, and notions concerning diagnosis and remediation of children's learning problems are in their infancy.

This paper presents the point of view that the establishment of university-based clinics for the diagnosis and remediation of children's learning problems in mathematics, while attending to the needs of today's education, will facilitate the maturation of diagnostic-remedial notions and foster a more scientific educative process. In expanding upon that point of view, the nature and rationale for such clinics is explored, and a brief description of one such clinic at Arizona State University is presented.

Nature and Rationale

Diagnosis and remediation of children's learning problems in mathematics can and does take place in many settings. In the school, teachers are sometimes able to successfully reteach students who did not learn well during initial teaching. Most of these teachers, however, rather than having knowledge of diagnostic-remedial procedures, possess a sixth sense for understanding their students and providing appropriate experiences. Diagnosis and remediation sometimes occurs in the home, but few parents possess the necessary mathematical and pedagogical knowledge. Peer and formal tutoring are yet other avenues for correcting student learning difficulties. Unfortunately, in all these settings efforts are generally aimed at correcting immediate problems; in few cases are there persons specifically trained for helping the child with deep-seated learning problems in mathematics.

The mathematics learning clinic is especially designed to help children with severe learning problems in mathematics. Through a thorough investigation of each child's mathematical development, specially trained clinicians probe for antecedent weaknesses in the child's mathematics background, inspect for patterns of disability, and prescribe systematic instruction.

A definite need exists for the establishment of such mathematics learning clinics throughout the United States. Z. P. Dienes (1963) indicated that:

> "The fact that mathematics is found difficult or unpleasant or both by so many people testifies to the existance of real learning difficulties."

Wilson (1967) quantified Dienes' notion by reporting that from 25 to 35 per cent of the children in grades 3 through 8 are underachieving in mathematics.[1]

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[1]These studies were conducted in middle class schools. As Wilson suggested, what might the rate be in schools serving the culturally disadvantaged?

Large numbers of children are not achieving in mathematics at a level consonant with their capabilities and are thus in need of diagnostic-remedial help.

Despite the commonplace recognition of learning problems in mathematics, few teacher education institutions appear to be preparing teachers to cope with such problems.[2] In a recent national survey of teachers' opinions, teachers placed "diagnosing student learning problems" high on their list of areas where they needed most help ("Finding Out . . .," 1972). While teachers may find themselves able to identify general content weaknesses of groups, they lack both the time and the expertise for effectively diagnosing and remediating moderate to severe learning problems of specific individuals.

Two reasons have thus been suggested for establishing diagnostic-remedial clinics in elementary mathematics--(1) to help individual children overcome their special mathematics learning difficulties and (2) to train teachers/specialists in clinical techniques of diagnosis and remediation.

Suydam and Weaver (1970) conducted a cursory survey of the literature on diagnosis as it relates to individualizing instruction in elementary mathematics; they implied that, although recent work has been done on diagnostic tests, current diagnostic procedures were in use around 1930 (Buswell and John, 1926; Brownell and Watson, 1936). While new theoretical models and the procedures they imply are beginning to appear, further development of models and procedures is needed, and hypotheses resulting from those models and procedures need to be tested. Such development and testing could lead to more effective treatment and perhaps prevention. A third reason for establishing mathematics clinics has thus been suggested--(3) to develop diagnostic-remedial models and procedures and conduct research related to their implementation.

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[2]The Florida Technological University has been conducting a national survey of college courses specifically designed to help teachers diagnose and remediate learning problems in mathematics.

Although there is an apparent need for mathematics learning clinics, few have been established. Similar clinics in the field of reading education have been widely established, and much progress has been made; Wilson (1967) indicated the existence of well over 150 university-based reading clinics in this country. To date, however, the only universities housing diagnostic-remedial clinics in mathematics are the Universities of Maryland and South Florida, and Arizona State University.[3]

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[3]While it is possible that other such clinics exist which were not located, the point remains that few have been established.

One Example of a Mathematics Learning Clinic

The mathematics learning clinic at Arizona State University is designed to fulfill three purposes. As suggested by the reasons for establishing such clinics, it is designed to provide service to the community, education and training for members of the teaching profession, and research and development for the academic community.

Specificially, the clinic's efforts are directed toward:

a. Helping children in the community who evidence learning difficulties in mathematics;

b. Providing teachers/specialists with (1) general models, clinical techniques, and practicum experience in diagnosis and remediation in mathematics, and (2) experience with new and varied materials appropriate to diagnosis and remediation; and

c. Devising instructional materials appropriate for training teachers/specialists in diagnosis and remediation in mathematics, developing theoretical models and procedures for diagnosis and remediation, and conducting research related to the development and implementation of those models and procedures.

Capsulated, the operations of the clinic at Arizona State involve student clinicians, in an appropriate clinical setting and using appropriate materials, (a) diagnosing and implementating remedial procedures with school children, and clinic personnel (b) coordinating these diagnostic-remedial encounters and (c) providing clinicians (graduate students, in-service teachers, and consultants) with instruction and experience in the methods and materials of diagnosis and remediation. Supporting these operations are the research and development efforts by clinic personnel.

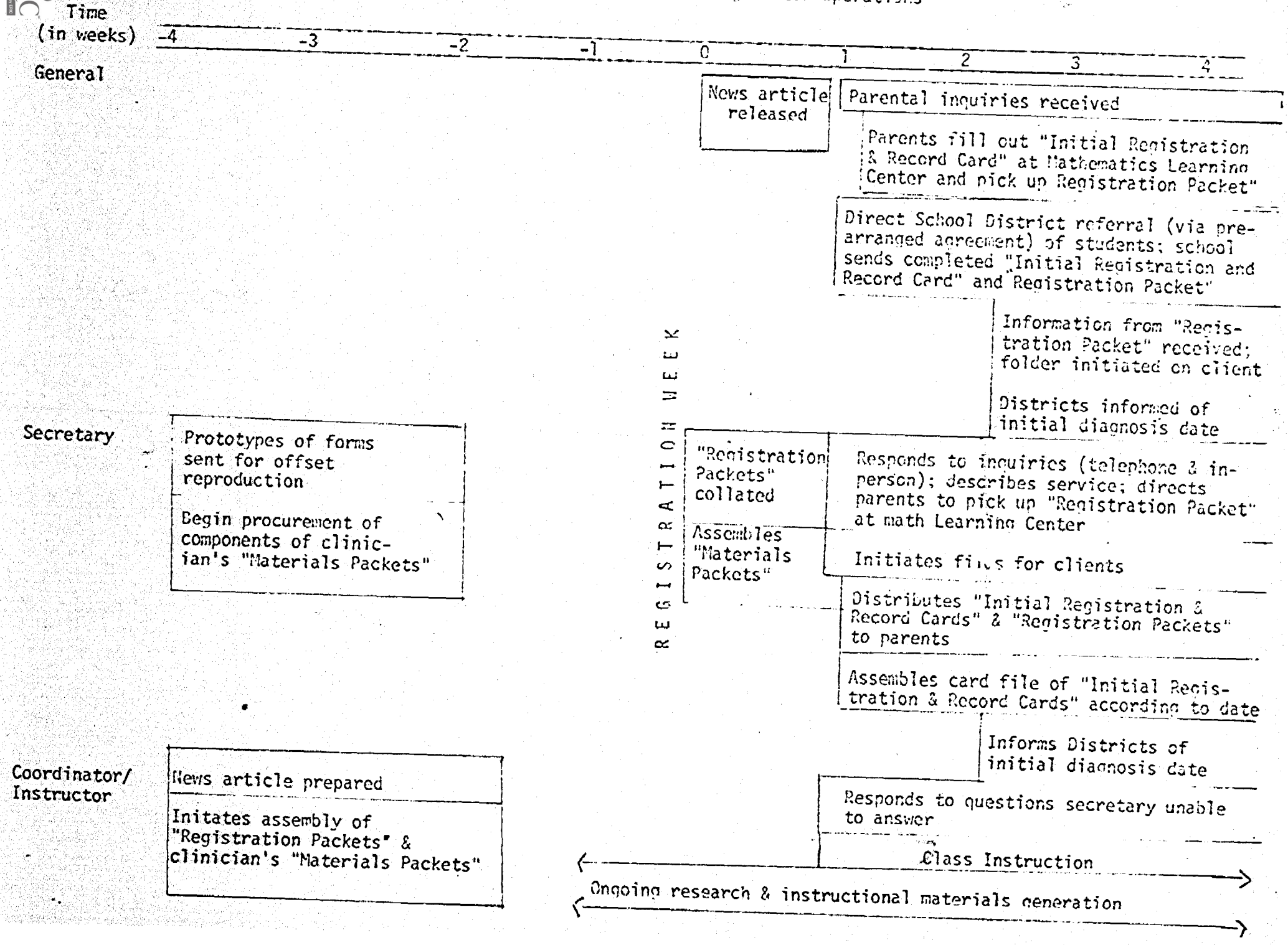
To expedite the clinic's functioning, clinical operations are integrated with a graduate course which focuses on diagnostic-prescriptive procedures in school mathematics. Under the guidance and supervision of a University instructor, these graduate students serve as clinicians--diagnosing mathematical deficiencies and strengths and prescribing remedial instruction. Facilities for the operations, materials, and personnel basically consist of two rooms. One room is divided into study carrels for student-clinician interactions, and the other contains a storage area for materials and equipment, a small office for instructor-clinician-parent conferences, and classroom space for clinician seminars. Materials used in the clinic are of three types: diagnostic tests for initial and continuing diagnosis, manipulative devices for use in remedial instruction, and professional references related to diagnosis and remediation in mathematics. Cassette audio-tape recorders are also available to aid clinicians in recording the events of remedial sessions for later analysis. (Videotape equipment would be a highly desirable addition.) Personnel for operating the clinic consist of a coordinator/instructor and a part-time secretary. The administrative plan for operating the clinic is presented in figure 1.

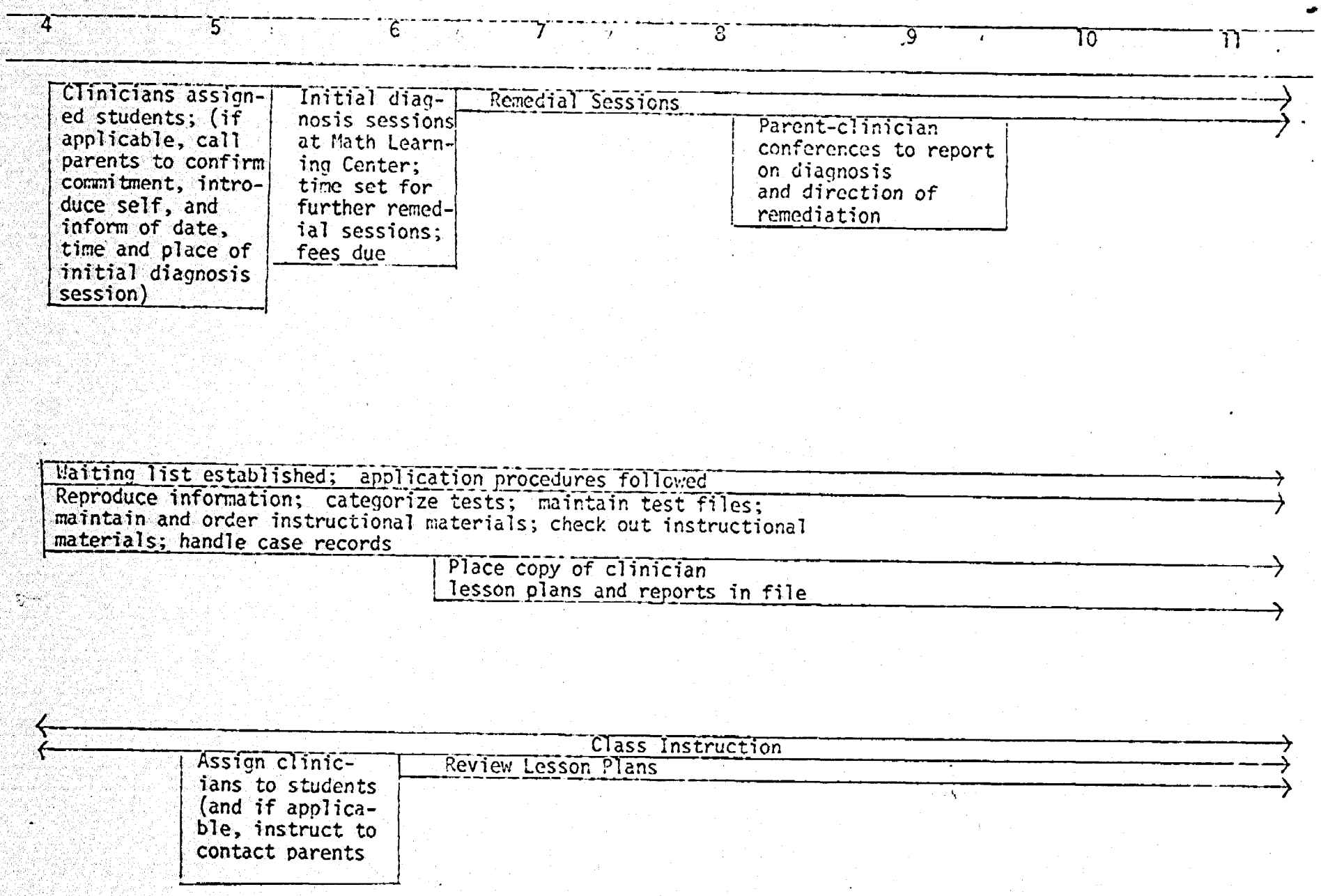
insert figure about here

In Conclusion

Although the clinic at Arizona State University is by no means a perfect example, it does illustrate the feasibility of establishing a university-based clinic for the diagnosis and remediation of children's learning problems in mathematics. More importantly, it demonstrates how universities can be of service to the community and the teaching profession, as well as contribute to the research basis of the educative process.

Figure 1. Chart of Mathematics Learning Center Operations

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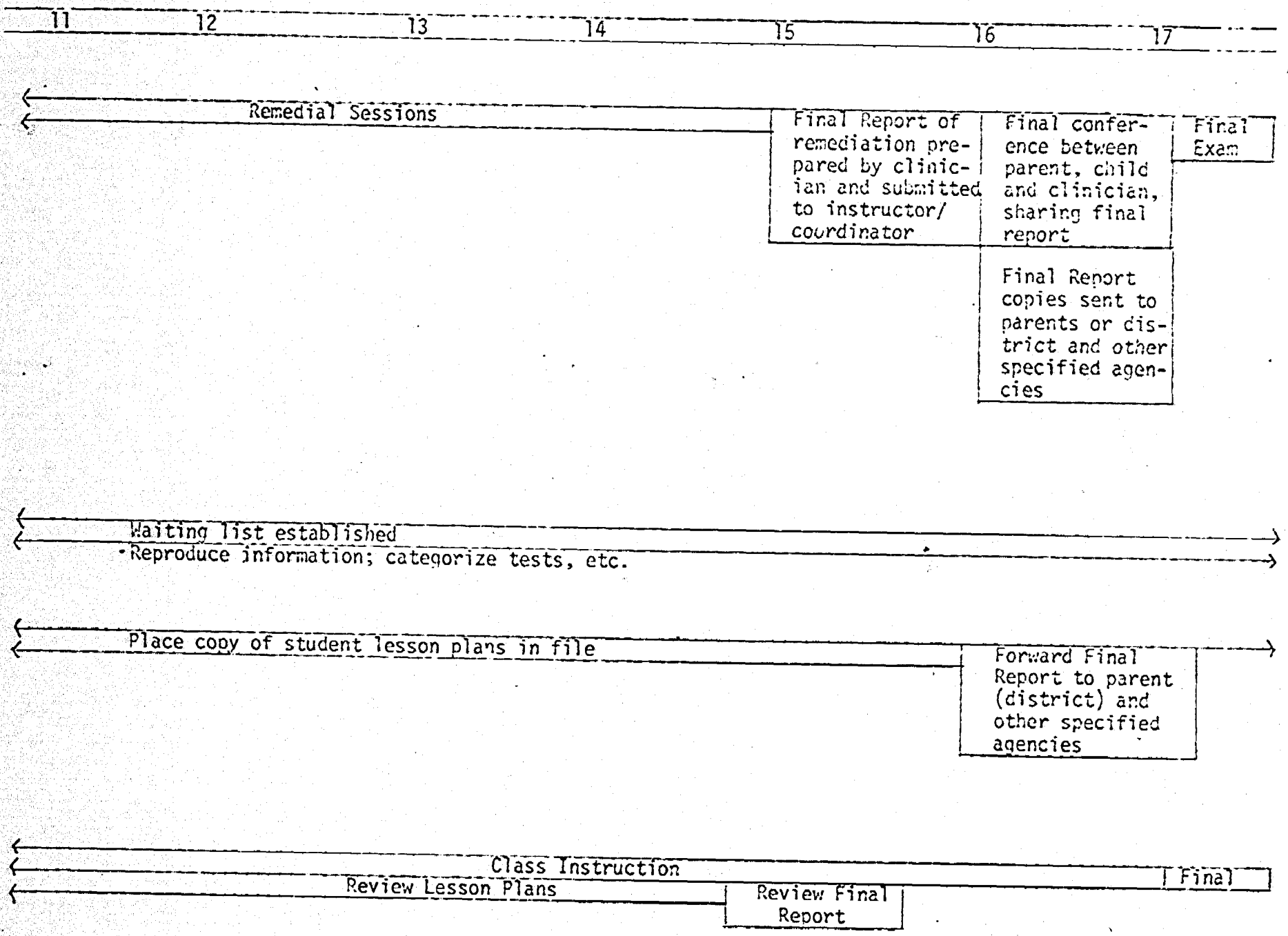
Clinicians assigned students; (if applicable, call parents to confirm commitment, introduce self, and inform of date, time and place of initial diagnosis session)
Initial diagnosis sessions at Math Learning Center; time set for further remedial sessions; fees due
Remedial Sessions
Parent-clinician conferences to report on diagnosis and direction of remediation
Waiting list established; application procedures followed
Reproduce information; categorize tests; maintain test files; maintain and order instructional materials; check out instructional materials; handle case records
Place copy of clinician lesson plans and reports in file
Class Instruction
Assign clinicians to students (and if applicable, instruct to contact parents
Review Lesson Plans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Remedial Sessions
Final Report of remediation prepared by clinician and submitted to instructor/ coordinator
Final conference between parent, child and clinician, sharing final report
Final Exam
Final Report copies sent to parents or district and other specified agencies
Waiting list established
Reproduce information; categorize tests, etc.
Place copy of student lesson plans in file
Forward Final Report to parent (district) and other specified agencies
Class Instruction
Final
Review Lesson Plans
Review Final Report

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