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ABSTRACT

This project studied the effects of implementing a computerized management information system developed for special education administrators. The Intelligent Administration Support Program (IASP), an expert system and database program, assisted in information acquisition and analysis pertaining to the district's quality of decisions and procedures in the process of student classification, placement, and the individual education plan (IEP). Output from the IASP was also used to support and monitor staff development activities. Assessment of baseline data from special education files of students who had been classified as learning disabled or intellectually handicapped revealed that existing school district interventions to reduce errors in student classification, placement, and the IEP process had been ineffective. A mentor team approach was established in four elementary schools using specially trained teachers to advise special education teachers in reviewing referrals for special education assessment. This approach resulted in reduced errors in assessments and decision making regarding students, compared to three secondary schools which did not use the mentor approach. Forms and samples of the IASP summary report, district intervention data, the classification tracking form, the classification consultation report, and corresponding graphs related to Chow statistics are appended. (Contains 27 references.) (SW)

FINAL REPORT

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Project Title:

THE DEVELOPMENT AND VALIDATION OF A SPECIAL EDUCATION INTELLIGENT ADMINISTRATION SUPPORT PROGRAM

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The Effects of a Computerized Information Management System on Classification, IEP and LRE Decisions

Abstract

This study evaluated the effects of a computerized management information system developed for special education administrators (IASP). The IASP generated information to guide staff development and in-service training. Effects were measured by program improvement in compliance procedures, the quality of IEP and LRE decisions, and the validity of classification decisions.

To determine the district's baseline status regarding errors in the assessment, classification, and IEP process, two data collectors conducted assessments of special education files of students who had been classified as learning disabled or intellectually handicapped using three validated expert systems. Two of the systems, Class.LD2 and Class.IH, were classification systems designed to provide a second opinion regarding the appropriateness of a specific classification. The third system, Mandate Consultant, gave advice on compliance with special education admission processes. Based on the results of the evaluation, the district administrators and staff designed several interventions to remediate the errors. Staff development interventions varied from group (e.g., IEP in-service) to individual (e.g., reviewing the classification process for learning disabilities). Length of staff development interventions ranged from 30 minutes to 3 hours.

Follow-up data collected through the IASP process indicated that the district interventions were not effective. As a result, the district and project staff designed a "mentor team" approach for processing all students newly referred for special education assessment. The teachers selected as mentor teachers served as advisors to their peers and received release time and training for their roles. Four randomly selected elementary schools served as an experimental group and three secondary schools were assigned as a comparison group. The mentor teachers were trained in five, 3-4 hour sessions conducted by project staff and district personnel. When a student was referred, a mentor teacher reviewed all requisite data with the special education teacher and processed the data with the appropriate expert system. This revised procedure ensured that the special education teacher participating in the child study team had been briefed by a "Mentor" before participation in decision-making processes.

Following intervention (i.e., the use of mentor teachers), data collectors again evaluated files of students who had been newly classified as Learning Disabled (LD and Intellectually Handicapped (IH). Results of the study indicated that the intervention was highly effective in reducing the total number of errors in the assessment, classification, placement, and IEP process in the experimental schools, while the errors in the comparison group remained unchanged. Further, this reduction in errors occurred across all experimental schools, all types of errors, and both the LD and IH handicapping conditions.

The findings strongly suggest that the combination of expert systems technology and a special education administrative data base created a powerful support system for progressively improving the quality of decisions. These decisions can have life-long implications for students being assessed for special education. The decisions also progressively and substantantively improved district staff development practices.

INTRODUCTION

One important application of computers for education administration is the use of computerized management information systems. In 1980, staff at Utah State University developed and validated MONITOR, a computerized management tool designed to evaluate students' progress through: (a) placement, (b) assessment, (c) IEP development, and (d) annual review and re-evaluation activities. The findings from the MONITOR project provided evidence that computerized information systems could be developed to support special education administration (Whitney & Hofmeister, 1983).

According to a survey by Buirello, Tracy, and Glassman (1983), 95 percent of special education administrators were highly interested in the implementation of computerized information management systems. However, until recently the applications and scope of such systems have been limited. The majority of systems have focused on (1) general record keeping, (2) IEP generation, (3) electronic mail systems, and (4) federal and state funding requirements for funding and program evaluation.

During the last five years, there has been a significant shift in the focus of computerized management systems. Previously, the question of importance was, "Should we implement computerized information systems in education?" Now researchers and educators are asking, "How do we most effectively design and implement such systems?" This shift in priorities has been facilitated by several factors, including (1) demonstrations of a variety of computerized information systems (Hayden, Vance, & Irvin, 1982; Hofmeister, 1982; Hofmeister, 1984; Ragghianti & Miller, 1982; Whitney & Hofmeister, 1983); (2) validation and effectiveness studies that identified strengths and weaknesses in computerized information systems (Demchak, 1986; Jenkins, 1987; Ryan & Rucker, 1986); and (3) increased use of computerized information management across educational administration, rather than just special education (Hofmeister, 1984).

In one such example, Ryan and Rucker (1986) found that computerized IEP program generated IEPs quicker and more efficiently and that teachers had a more favorable attitude toward the IEP for instructional planning than did teachers using non-computerized IEP systems. In addition, use of the computerized IEPs was more cost-effective than non-computerized IEP systems. Similar results of studies evaluating computerized IEPs have been reported. In a study by Jenkins (1987), the experimental group using computer-generated IEPs took significantly less time to develop their IEP's and that the quality of the computer-generated IEP was superior to the hand-written IEP.

The fact that several studies support the utility and validity of computerized information systems does not mean that all systems are practical and/or effective. In a related study, Bennett (1984) noted several administrative misconceptions regarding the use of computerized information systems. First, all automated special education information management systems will not save money, and some may actually generate increased paperwork and expensive redundancy. Second, automated systems do not automatically correct confusions and misinterpretations in information. In fact, some may serve to "institutionalize" rather than remove existing problems. Finally, an automated system will not run by itself. Computerized information management systems require individuals with the expertise and know-how to operate these systems and to evaluate the output. A substantive investment in staff training is needed.

Ryan and Rucker's (1986) data-based study was generally supportive of computerized IEP process. However, the researchers identified several questions that remained to be addressed:

1. Did time saved in the use of computerized IEP's translate into increased instructional time spent with students?
2. How can the computerized IEP process enhance the quality of IEPs?
3. How can computerized information processing ensure the "efficacy of the IEP" as a functional, individualized blueprint of the intervention the child receives?

In summary, there are clear trends in the use of computerized information management systems. The potential contribution of computerized systems has been well documented and recognized and researchers are beginning to address such critical issues as quality development and implementation as it relates to improved services for children with disabilities.

Expert Systems Technology

Sowizral and Kipps (1986) describe an expert system as a "rule-based artificial intelligence application program for doing work that requires expertise." They further identify the components of an expert system as a knowledge base with data and an internal engine that manages the interaction. Expert systems are designed to be interactive and typically engage the user in a dialogue that parallels the type of conversation that a person might have with an expert consultant. The computer is programmed to ask the user questions to clarify the problem or situation (Barr & Feigenbaum, 1981). The system then combines the information with facts and rule-based logic in the knowledge base to produce advice regarding a particular problem (e.g. appropriateness of classification).

For example, MYCIN is a well-known medical system for physicians that led to instructional applications (Davis, Buchanan, & Shorthiffe, 1975). With MYCIN the user enters information into the computer regarding the characteristics of the patient's symptoms (e.g., temperature, blood count, etc.). The computer matches the patient's data with information pertaining to characteristics of bacterial cultures and then, based on programmed logic presents a disease diagnosis. The MYCIN data base was later used in an intelligent computer-assisted instruction program called NEOMYCIN (Clancy & Letsinger, 1981) to teach physicians to diagnose bacteriological diseases.

Special Education Application of Expert Systems

Until recently there has been little application of expert system technology to the field of education (Hofmeister & Ferrara, 1986). However, with the increased power and availability of computer hardware and the gains in artificial intelligence, the development of expert systems for educators became feasible.

Researchers at Utah State University's Artificial Intelligence Research and Development Unit (AIRD) have developed various expert systems designed to provide special educators with recommendations regarding a student's eligibility for special education. Hofmeister and Ferrara (1986) developed Class.LD2, an expert system that provides a second opinion on the eligibility of students with learning disabilities. The development of Class LD2 was followed by the development of Mandate Consultant, an expert system that gives advice on compliance with special education admission processes and on IEP procedures. Class .IH, an expert system similar to Class.LD2, provides a second opinion regarding the appropriateness of an intellectually handicapped classification. Both Mandate Consultant and Class.LD2 were subjected to a series of validation, replication, and training studies to assess the accuracy and general utility of the two expert systems. Results showed that the decision-making ability of the two systems performed as well as the top 10 percent of the human experts (Hofmeister & Lubke, 1986; Parry & Hofmeister, 1986). With minor adaptations, the systems could also function as effective inservice training tools (Prater, 1987). In the most recent validation study, school districts using Class LD2 improved the quality of LD classification decisions by more than 20 percent. The comparison group showed no improvement (Hofmeister & Likins, 1988).

It is clear that expert systems can improve the quality of classification decisions (Hofmeister & Likins, 1988) and can serve as effective inservice tools between the low and high model complex decision making (Prater, 1987). However, expert systems are limited in that they review problems on a case by case basis and are not designed to address district-wide staff training and compliance issues (Thornberg, Baer, Ferrara, and Althouse, 1990). There is a need to develop a computer-based support for special education administration. A support system that could integrate the individual expert systems with a comprehensive administrative data base to facilitate the development of special education programs and staff.

Intelligent Administrative Support Program (IASP)

The development of a powerful, integrated data management system would be unique in the field of education. If such a system were (1) delimited to decision areas covered by previously-developed expert systems, (2) providing information on compliance errors to a central database, then, a computerized information system could be designed with both information acquisition and decision support functions for special education administration.

The major purpose of this study was to conduct a formative and a summative evaluation of a computerized management system developed for special education administrators. Specifically, the "Intelligent Administration Support Program" (IASP) was designed to assist special education administrators in information acquisition pertaining to the district's quality of decisions and procedures in the classification, placement, and IEP process. Additionally, output from the IASP was used to support and monitor staff development activities.

OBJECTIVES AND RESEARCH QUESTIONS

The delivery and improvement of any special education service is premised on the notion that the child is eligible for special education services. The research collected to date suggest that there is little to support such an assumption with students with mild handicaps (e.g., learning disabled, intellectually handicapped). The purpose of this project was to develop a computerized information system to guide the progressive improvement of special education programs in compliance procedures, the quality of IEP, and the validity of classification decisions. To meet this objective, the Intelligent Administrative Support Program (IASP) was developed and field tested. IASP was designed to assist special education administrators and district staff of special education programs.

Objectives

Specific objectives of the project were:

1. To determine if a district could use the output of the IASP to design and monitor effective forms of staff programming and training.
2. To determine if use of the IASP data in conjunction with district interventions would result in a reduction of errors with state and federally mandated procedures in the areas of classification of mildly handicapped students.

Research Questions

Learning Disabilities

1.1 Relative to pre-implementation, did the IASP process result in a reduction of the number of overall errors in classification of learning disabled students?

1.2 Relative to pre-implementation, did the IASP process result in a reduction of the number of decision errors in classification of learning disabled students?

1.3 Relative to pre-implementation, did the IASP process result in a reduction of the number of suspect measures used in the classification of learning disabled students?

1.4 Relative to pre-implementation, did the IASP process result in a reduction of the number of procedural errors in classification of learning disabled students?

Intellectually Disabled

2.1 Relative to pre-implementation, did the IASP process result in a reduction of the number of overall errors in classification of intellectually disabled students?

2.2 Relative to pre-implementation, did the IASP process result in a reduction of the number of decision errors in classification of intellectually disabled students?

2.3 Relative to pre-implementation, did the IASP process result in a reduction of the number of suspect measures and procedural errors in classification of intellectually disabled students?

IEP Procedures

3.1 Relative to pre-implementation, did the IASP process result in a reduction of the number of overall compliance errors associated with federal and state mandated IEP procedures?

3.2 Relative to pre-implementation, did the IASP process result in a reduction of the number of federal and state mandated procedure errors prior to the IEP meeting?

3.3 Relative to pre-implementation, did the IASP process result in a reduction of the number of procedural errors associated with the development of the IEP document?

3.4 Relative to Pre-implementation, did the IASP process result in a reduction of the number of errors associated with the federal and state mandated procedures in an IEP?

METHODS

The methods section includes a discussion of the (a) subjects, (b) procedures, (c) instruments and data collection, (d) research design, (e) procedures, and (f) analysis of data. The following is a detailed description of each portion for accomplishing the project objectives.

Subjects

The target population for this study was all public school districts in Utah. The accessible population was limited to Ogden City School District in Ogden, Utah, an inner-city district with the largest minority population of any school district in the state. The district also had a large transient population.

The seven schools were randomly selected from all public schools in the Ogden School district. Four elementary schools were assigned to the experimental group and three secondary schools served as a comparison group. Elementary schools were selected to serve in the experimental group because of the extent of interaction and cooperation that project staff required to access files and to facilitate the performance feedback process within the district. In addition, other elementary schools were not selected to serve as a control sample because of potential contamination resulting from the "mentor teacher" model. The "mentor teacher" model in which an experienced, well-qualified teacher shares his/her expertise with more inexperienced teachers, was emphasized and practiced throughout the district and state--especially at the elementary level.

The Intelligent Administration Support Program (IASP) was designed to assist special education administrators in information acquisition pertaining to the district's quality of decisions and procedures in the classification, placement, and IEP process. Additionally, the IASP consisted of an expert system as well as a database program and special education student "cache" files generated by other validated expert systems, Class.LD2, Class.IH, and Class.MC. An overview of the IASP system is summarized in Table 1.

The development and validation of the IASP occurred in four major project design phases: (a) content clarification and system design, (b) development and field test of the prototype and revisions, (c) main field test with program evaluation, and (e) final revisions based on field test data (see Figure 1). Each of the phases will be discussed in terms of specific activities.

Table 1. An Overview.

The Intelligent Administrative Support Program (IASP): An Overview

Separate Expert Systems Provide	Information on the quality of decisions and procedures which can be cross-referenced with	An intelligent database which provides the special education administrators with	Individual staff, schools, K-12 divisions, and program units to provide direction to	Program evaluation and staff development activities
Expert Systems Include: 1. Mandate Consultant 2. Class.LD 3. Class.IH	Information Would be Provided on: 1. Compliance with procedures to admit students to special education, 2. The quality of IEPs and LRE decisions, 3. The validity of classification decisions	The Intelligent Database Consists of: 1. A district wide relational database, and 2. An expert system to evaluate the sampling and retrieve the information in keeping with user needs	Examples of Units of Analysis Include: 1. Individual staff 2. Individual schools 3. K-12 units e.g., elementary, middle school, high school 4. Special education program units, e.g., mildly disabled, severely disabled.	Program Improvement Would be Aided by: 1. IASP data on prescriptions for staff development, (e.g., which skills need to be mastered by which staff), and 2. Data analyzing the impact of staff development experiences and related program changes.

Figure 1. Major Project Phases.

Phase 1	Phase 2	Phase 3	Phase 4
Content Clarification and System Design	Development and Field Test of Prototype and Revisions	Main Field Test with Program Evaluation	Revisions Based on Field Test Data

Content Clarification and System Design

Before designing a new expert system, it was necessary to review the literature to identify recent developments and practices. In addition to the review for the proposed project, a group of professionals from special education met to substantiate and clarify the problems to be addressed by the project. The group included: (a) a staff member from the Utah State Office of Education, (b) a special education administrator from a local education agency, (c) a Utah State University (USU) faculty member from the Special Education Department, and three staff members from the USU Artificial Intelligence Research and Development Unit.

The professionals required several meetings to clarify and define answers to the following system questions:

a. What type of problem should the system address?
b. What type of information output should the system provide?
c. Who should use the system?
d. What computer software and hardware hold the most promise?
e. How should the system be used?

Prototype Development and Revisions

Several prototypes were developed and revised during the formative evaluation. While initial stages of development focused on individual components or modules, the latter stages addressed the relationships and interactions among the various modules and overall system performance. Some of the key modules included in the system were: (a) the central structure of the data base, (b) the coordination and revision of "feeder" expert systems, (c) the information acquisition and user interface, (d) the expert system for the intelligent front end to the data base, (e) the report generator and information retrieval, and (f) the system documentation.

To increase the content validity of the IASP outcomes, the project staff and district coordinators reviewed the content of the IASP outputs. Any outputs that were unclear were modified in that meeting to meet the administration's needs. The format for the summary report was modified substantially to facilitate understanding. Some of the modifications included: (a) the addition of headings and columns to better organize the data, (b) the addition of frequencies specific to student and school, (c) a full description versus an abbreviated version of the specific problem or violation of state and federal rules, (d) a list of the students' files that were evaluated, and (e) the certainty factor (cf) that was associated with the likelihood that a student should be classified. Examples of an IASP summary report are included in Appendix A.

The primary design specifications that served to guide and evaluate the product development during the formative evaluation period were (a) the software development systems and languages, (b) the hardware requirements for field use and central information management, (c) the user information regarding collection and interpretation needs, (d) dissemination and maintenance costs of total system, (e) the nature of the availability and validity of information collected, (f) the practicality of the content and format of reports generated by the system, (g) the potential for political threats, generated by such issues as staff evaluation, (h) the potential for legal threats, generated by possible conflicts with state and federal regulations, (i) the potential for enhancing special education program credibility with staff, other administrative units, the community, and special education students and their families, (j) staff development costs associated with the use of the system, and (k) the relationship between the IASP and district administrative and program evaluation policies.

Main Field Test and Program Evaluation

Dependent Variables

The dependent variables for the main field test included, (a) overall errors, decision errors, suspect measures, and procedural errors in classification of learning disabled students, (b) overall errors, decision errors, and procedural errors or suspect measures in classification of intellectually disabled students, (c) overall compliance errors, errors prior to the IEP meeting, errors associated with the development of the IEP document, errors associated with the IEP meeting. More detailed information and specific examples of each dependent variable is listed in Table 2. The dependent variables were identified by the research literature reviews and combined with the recommendations of the special education administrators and staff of Ogden City Schools.

Data Collection

As a part of the systems design, it was necessary to assess the district baseline status regarding errors in the assessment, classification, and IEP process. To identify procedural errors, two data collectors conducted assessments of students special education files who had been classified as learning disabled, and intellectually handicapped within the current school year. Three to four student files were randomly selected from each handicapping category per school. To facilitate the random selection process, a roster of newly classified special education students was generated by the district office for each school from which students' names were randomly drawn. Pre-intervention data collection occurred during Spring of 1990 prior to the use of the IASP and district interventions.

Following intervention, the same data collectors again evaluated files of students who had been newly classified as learning disabled and intellectually handicapped during the Fall of 1990 to Spring of 1991. The student's files were randomly selected from the same target population. As in the prior evaluation, 3-4 student files from each handicapping condition for each school were evaluated. The evaluation procedures and expert systems used were the same as those described for pre-intervention.

A total of 383 special education students' files were reviewed during the pre- and post-assessment period. Of those files, 179 were files of students who had been classified as Learning Disabled (LD), and 71 files were those of students who had been classified as intellectually disabled (IH). The expert system, Mandate Consultant (MC) was used to review 133 files for IEP and due process procedural errors. These files were randomly selected from the LD and IH files previously reviewed. The total number of files reviewed in the comparison and experimental groups appear in Table 3.

Table 2. Description of errors found in files of students who had been classified as learning disabled (LD) or intellectually handicapped (IH).

Type of Errors	Examples
Overall Errors Decision Errors	• Total number of errors per student file • Misclassification or Non-LD explanations • Poor-classification (i.e., less than 50 percent confidence that the student can be classified LD or IH)
Suspect measures	• Old, missing, or incomplete result(s) of vision or hearing test • Inappropriate or unqualified tests (e.g., IQ test or academic test must be approved by the state guidelines for LD classification) • IQ score is less than 75 for LD, or greater than 75 or less than 60 for IH • Missing documents required by state (i.e., Classification Summary, Scrams, IQ tests, parental permission, referral for evaluation, etc.) • Missing adaptive test for IH • Suspect adaptive test score (i.e., very low or high) • Academic achievement is not assessed
Procedural Errors	• Classroom observation(s) is missing or incomplete • Prereferral interventions are missing or incomplete • More than 30 days lag between parental permission and initial date of assessment • Signatures and dates on protocols in pencil • Documentation of prior notice is missing
Overall Errors	• Total number of errors per student
Errors prior to IEP meeting	• IEP document(s) missing • IEP document(s) not completed within 30 days of classification date • More than 30 days between parent permission and student evaluation • Missing or incomplete prereferral intervention(s)
Errors associated with IEP meeting	• Absence of regular teacher • Absence of public agency • Absence of parents • Absence of special education teacher • Lack of acceptable assistance to the parent whose primary language is not English
Errors associated with the development of IEP documents	• The IEP document is not reviewed within one-year • Missing signatures or titles of team members • Signed after services are initiated • Failed to state or incompletely stated demographic information, student's involvement in regular education or special education, or related services • Missing or incomplete annual goals, short term objectives, evaluation procedures and/or schedules, or present levels of performance statement(s)

Table 3

Number of Student Files by Group and by Handicapping Condition

Group	Total	LD	IH	MC
Experimental	225	111	40	74
Comparison	158	68	31	59
Total	383	179	71	133

Table 4 presents the number of student files reviewed in the experimental group by school. The data indicate that there was an unequal distribution across schools of the files classified as intellectually disabled. Only three students were classified as intellectually disabled in School 4, while School 2 classified 21 students classified as intellectually disabled. Furthermore, the three students' files in School 4 were classified during pre-intervention period. There were no students newly classified as intellectually handicapped during the post-intervention period. The lack of files and their unequal distribution across schools limited generalization of the results.

Table 4

Number of Student Files by School and by Disabled Condition in Experimental Group.

School	LD	IH	MC
1	39	7	22
2	23	21	17
3	31	9	16
4	18	3	19
Total	111	40	74

Table 5 shows the distribution in the experimental group by school year. Files evaluated during pre-intervention were selected from files of students classified during the last three school years (i.e., 1987-88, 1988-89, and 1989-90 school year). The post-intervention files consisted

Table 5

Number of Student Files by School Year and by Disabled Condition in Experimental Group.

School Year	LD	IH	MC
1987 - 1988	3	8	7
1988 - 1989	43	13	10
1989 - 1990	37	6	25
1990 - 1991	28	13	32
Total	111	40	74

only of newly classified students (i.e. 1990-91) school year. A total of 152 files were reviewed during the pre-assessment period, of those files, 83 files were LD, 27 files were IH, and 42 files were MC. During the post-assessment period, a total of 73 files were reviewed. Of those files, 28 files were LD, 13 files were IH, and 32 files were MC.

To conduct the file assessment, the data collectors used three expert systems:

Class.LD2 is an expert system designed to provide a second opinion regarding the appropriateness of a learning disabilities classification based on Utah and Federal regulations related to P.L. 94-142.

Class.IH is an expert system designed to provide a second opinion regarding the appropriateness of an intellectually disabled classification based on Utah and Federal regulations related to P.L. 94-142.

Mandate Consultant (MC) is an expert system which focuses on administrative issues in IEP development. It is designed to provide advice regarding the individualized education program development procedures mandated by P.L. 94-142 and Utah rules and regulations.

Both Mandate Consultant and Class.LD2 have been subjected to a series of validation, replication, and training studies to assess the validity, generalizability, and general utility of the two systems. When the decision-making ability of the two systems was compared with that of human experts, the systems performed as well as the top 10 percent of the comparison population (Parry & Hofmeister, 1986; Hofmeister & Lubke, 1986; Martindale, Ferrara, & Campbell, 1988). It was also found that with some adaptations, the expert systems could be used as effective inservice training tools because of their ability to model complex decision-making (Prater, 1987). In the most recent validation study involving Class.LD2, using randomly assigned treatment and comparison groups, the quality of LD classification decisions improved by more than 20 percent in school districts using Class.LD2. The comparison group showed no improvement in the quality of LD classification decisions (Hofmeister & Likins, 1988).

Conducting a Consultation

To use one of the expert systems, the data collectors examined the student's folder independently and answered questions that were generated by the expert system pertaining to the specific handicapping condition and the classification process. The consultation typically required 15-20 minutes. At the end of the consultation, the expert system provided advice and a rationale based on the data entered. As a part of the consultation process, each expert system generated a memory cache, or individual file on the characteristics of the particular case. The cache files contained a record of all the findings, inferences, and conclusions for each student consultation. In the case of Class.LD2, the cache could have contained up to 170 pieces of information on student characteristics, instructional history, the classification decision, and other advice. The cache files were read and evaluated by the IASP to generate a large database. The database contained final conclusions, intermediate conclusions, the data upon which the conclusions were based, and a specific list of the type and frequency of classification and placement errors in all student files.

Reliability

To assess reliability, two data collectors conducted independent assessments of at least three of the same students' files for each disability condition and school using the expert systems. The consultation outcomes were then compared on a question by question basis to determine agreement. Percent agreements were calculated by dividing the number of agreements by total number of agreements and disagreements. The data collectors maintained an average of 90 percent agreement across all student files reviewed, with a range of 80 percent to 100 percent.

To verify the data generated by the IASP, the project staff randomly selected 20 percent of student files, and compared the IASP data with written summary reports from selected files. Conclusions generated by the IASP did not differ significantly from the written summary reports.

Interventions

Project staff presented Ogden administrators and staff with the data from the pre-assessment. The frequency and types of procedural errors for each school were summarized and discussed in relation to staff training needs. It was determined that each district coordinator would use the data to plan and implement specific staff development interventions with individuals they supervised. The district coordinators were asked to maintain a record of the type of interventions that was implemented and to provide descriptive information regarding the outcome and follow-up measures (see Appendix B). In addition, on-going data summaries from the IASP assisted the district personnel in monitoring the interventions. A summary of initial interventions that were implemented by the Ogden district staff is presented in Table 6. Interventions ranged from group (e.g., IEP inservice for entire special education staff) to individual (reviewing the LD classification process). One district-wide memo was sent to clarify a procedure regarding hearing test results. Length of intervention ranged from 30 minutes to 3 hours. Follow-up data from the IASP indicated that the district interventions were not effective. As a result, a higher intensity staff development intervention was designed by the district and project staff.

The district's special education director and coordinators selected six special education teachers to serve as a "mentor team". The six teachers had an average of ten years teaching experience. Five of the teachers were resource teachers and one was the teacher of a self-contained unit serving children with behavior disorders. All of the teachers were considered mentor teachers and frequently supervised or trained peers in the district.

The purpose of the mentor team was to screen and review the assessment and classification process for all students newly referred for special education in the elementary program. Each mentor was equipped with a portable computer and the following expert systems: Class.LD2, Class.IH, and Mandate Consultant. Prior to the beginning of school, the mentor team received extensive training. During five, 3-4 hour training sessions conducted by project staff and district coordinators. Content of the training included: (1) review and discussion of the state and federal rules for qualifying students under each handicapping condition; (2) demonstration and hands on practice with the expert systems using student files; (3) overview of computer basics and an introduction to DOS (disk operating system). In addition to training, the mentor team redesigned all district classification forms (e.g. LD, IH, and BD) to facilitate compliance with state and federal rules and developed a classification tracking form (see Appendix C) to assist the team and the district in monitoring the student's progress from referral through the assessment,

Table 6. Ogden District Initial Interventions.

Target Area	Intervention		How Long	Results	Follow-up
	Group/Ind	Description			
LD Classification	Individual one-on-one	Check on classification process/conformity with district policy	30 min	6 files reviewed 2 of 6 correctly completed	Additional Service
Assessment	Individual one-on-one	Appropriate use of measures of adaptive behavior	30 min	To be determined	Special Ed. will monitor future IH referrals
LD Classification	Individual one-on-one	Check on classification process/follow-up to previous visit	30 min	2 files reviewed 1 of 2 correctly completed	continue to monitor
IEPs	Group (N=20)	District Inservice including: a. current levels of performance b. annual goals and objectives c. monitoring	3 hrs	Teachers turned in an IEP for critique must meet 90% criterion	A second IEP by those who did not meet criterion was completed and evaluated.
The Special Education Referral Process	Group (N=20-30) per school	Faculty Inservice at 5 schools issues discussed: a. appropriate referrals b. pre-referral interventions c. accuracy of vision, hearing, and bilingual screening data	1 hr 15 min	To be determined by appropriateness and completeness of future referrals	
Hearing Test Results	Individual	Memo sent to all special personnel informing them of procedures to access results	N/A	Check future files to determine if results are recorded	Continue to monitor

classification, and placement process. If a student did not qualify, the multidisciplinary team recommendations at the school were recorded and follow-up data were noted. Each mentor was assigned to serve three elementary schools in the district and was released from their teaching duties two half days a week. A permanent substitute teacher was hired to fill in for the mentor during this time.

As a team member, the mentor would visit each assigned school once a week. When a student was referred for special education, the special education teachers were directed to contact their mentor teacher who would review the screening data (e.g. vision and hearing tests, bilingust, etc.) with the teacher and then direct the teacher to collect specific data. After the assessment was completed, the resource teacher would again contact the mentor teacher who would run a consultation using the appropriate expert system and specific student data. The results of the consultation and program advice were presented in an expert system summary report and discussed with the special education teacher (see Appendix D). The teacher was then directed to share the results with the multidisciplinary team as a part of the assessment process. Final classification decisions were always determined by a school's multidisciplinary team, rather than the summary report. The expert system summary report was considered a second opinion to facilitate the decision-making process. To facilitate implementation, district staff designed flowcharts of the mentor team process for each classification. The LD and IH flowcharts are included in Figures 2 and 3 respectively.

Several follow-up meetings were held throughout the school year with the project staff and mentor team to review problems and to provide support. Problematic issues included: (1) faculty complaints regarding length of time to classify a student, (2) program bugs, (3) multidisciplinary teams overriding state guidelines with little or no documentation, and (4) insufficient or incomplete data to process an expert system consultation.

Following intervention, the same data collectors again evaluated files of students who had been newly classified as learning disabled and intellectually handicapped during Fall of 1990 to Spring of 1991. The data collection and evaluation procedures and expert systems used were the same as those described for pre-intervention.

Classification Process for Students with a Suspected Handicap of Specific Learning Disabilities

Written prior notice
Referral
Permission to evaluate

Contact district mentor team member to notify of case. The following information will be necessary:

1. Date
2. Student name
3. Teacher/school
4. Date of written prior notice and permission to evaluate
5. Suspected handicap
6. Vision and hearing screening dates and results

Mentor teacher completes information checklist and instructs teacher to proceed with usual evaluation/information gathering procedures.

Follow usual procedures for evaluating and gathering pertinent information regarding the student. Contact the school psychologist on new referrals and make arrangements for a WISC-R or WPPSI to be administered. This will save teacher testing time and duplication of effort.

Upon completion of the evaluation/information gathering, make a second contact with the mentor teacher to inform him/her that you are ready to have the case run through the LD expert system.

Mentor teacher comes to the school during his/her regularly scheduled time and inputs the information gathered into the LD expert system computer program which will provide an opinion (certainty factor) as to whether or not the student should be considered learning disabled.

Conduct a classification team meeting to discuss testing results with parents. Note: If the student is eligible for service the IEP may also be written at this time.

Figure 2. Classification process for LD

Classification Process for Students with a Suspected Handicap of Intellectually Handicapped

Written prior notice
Referral
Permission to evaluate

Contact mentor teacher to notify of case. The following information will be necessary:

1. Date
2. Student name
3. Teacher/school
4. Date of written prior notice and permission to evaluate
5. Suspected handicap
6. Vision and hearing screening dates and results

Mentor teacher completes information checklist and instructs teacher to proceed with usual evaluation/information gathering procedures (Reminding teachers that an adaptive measure is required).

Follow usual procedures for evaluating and gathering pertinent information regarding the student. Note: An adaptive measure (i.e. VINELAND, AAMD) is required. When all information is gathered, contact the district psychologist to request a WISC-R/WPPSI and to get the adaptive scored.

When you receive a statement of findings back from the psychologist, make a second contact with your mentor teacher to schedule a time to run the information through the IH expert system.

Mentor teacher comes to the school during his/her regularly scheduled time and inputs the information gathered into the HI expert system computer program which will provide an opinion (certainty factor) as to whether or not the student should be considered intellectually handicapped.

Conduct a classification team meeting to discuss testing results with parents. Note: If the student is eligible for service the IEP may also be written at this time.

Figure 3. Classification process for IH

Research Design

An interrupted multiple time-series analysis design (Glass, Wilson, & Gottman, 1975), employing a non-equivalent comparison group, was used to investigate the effect of the IASP on the dependent variables. A time-series design was selected to analyze the data in the study for a number of reasons. First, student files evaluated prior to and after intervention were not the same. Because individual files have different characteristics (i.e., the degree of disability, schools, grade, or teachers, etc.), a normal per- and post-test design was not considered appropriate.

Second, the most basic time-series experimental design involves some number of repeated observations, "0", of an outcome variable across time with an intervention, "I" introduced between two observations: A change in some property of the observations (i.e., level and trend) that coincided with the "I" might have been the effect of "I" on the outcome variable intervention (Campbell, 1969; Glass, Et al., 1975). As a result, time-series designs and associated data analysis techniques were recommended to facilitate more accurate interpretations of the intervention effects than a one-group pretest and posttest design (e.g., changes in level, trend, or both).

To conduct the time-series design, successive observations were collected prior to and after interventions from the experimental and comparison groups to assess the impact of the IASP process. The comparison group, consisting of three secondary schools, was used to examine historical threats to the design. Multiple factors, such as changes on state guidelines, teachers' or paraprofessionals' attitude, number of special education students, or support from other teachers, could effect the outcome measure. To control for these potential factors or rival hypotheses, the multiple time-series design compared the data from the experimental group. consisting of four elementary schools, with that of a comparison group (three secondary schools).

The multiple group time-series design is diagrammed in Figure 4. The notation employed is as follows: "I" depicts an intervention into the sequence of observations. The compliance errors per student classified as learning disabilities are represented by 0A, the compliance errors per student classified as intellectually disabled are represented by 0B, and the compliance errors with IEP development per student served in special education are presented by OC. The numbers followed after notations represents the number of files reviewed. Experimental and comparison observations are separated by a dashed line.

0A-1 0A-2	. .	0A-82 0A-83	I	0A-84	.	0A-111
0B-1 0B-2	. .	0B-26 0B-27	I	0B-24	.	0B-49
0C-1 0C-2	. .	0C-41 0C-42	I	0C-43	.	0C-74
- - - - -	- -	- - - - - -	-	- - - -	-	- - - -
0A-1 0A-2	. .	0A-49 0A-50	I	0A-51	.	0A-68
0B-1 0B-2	. .	0b-18 0B-19	I	0B-20	. .	0B-31
0C-1 0C-2	. .	0C-40 0C-41	I	0C-42	.	0C-59

Figure 4. The multiple group time series design.

Data Analysis

The means and associated standard deviations of the dependent variables during pre- and post-interventions were computed. The means and standard deviations were used to identify degrees of variation in the observational data associated with the IASP. In addition, effect sizes were computed with the pre- and post-assessment means of each dependent variable in conjunction with the p-values to determine the magnitude of the difference between error means of the dependent variables during pre- and post-interventions.

Chow-tests with dummy variables were then used to analyze the data. The Chow-test is a statistical technique that tests differences between two or more regression lines (Gujarati, 1970). However, according to Gujarati (1970), the Chow-test doesn't explicitly tell whether the difference between two or more regressions is due to the intercept or the slope, or both. To specify the source(s) of the difference, Gujarati (1970) introduced the use of the dummy variable (D) in the regression equation. For example, D is assigned 0 for the observations conducted prior to interventions and 1 for observations completed after interventions. The dummy variable approach identifies the difference between two regression lines and whether it is due to the intercept, or the slope, or both. A significant result (i.e., t-associated statistics of intercept or slope, or both) would indicate that the profile of the variables differed significantly from pre- to post-assessment due to the reduction of errors (intercept) or the increased/decreased trend (slope), or both.

Results and Discussion

Data were gathered from special education student files using three validated expert systems and analyzed on a pre/post intervention basis to assess the impact of the Intelligent Administration Support Program (IASP) process on the compliance procedures, the quality of IEP and LRE decisions and the validity of classification decisions in seven schools in Ogden School District. The raw data collected during pre- and post-intervention are included in Appendix F. This report presents the results of the evaluation as it relates to the research questions presented in the Introduction. The first section discusses the findings for the files of students classified as learning disabled, the second section describes the findings for the files of students classified as intellectually disabled, and the third section discusses the findings relative to federal and state rules mandated for IEP procedures.

Learning Disabilities

Evaluation Question 1.1: Relative to pre-implementation, did the IASP process result in a reduction of the number of overall errors in classification of learning disabled students?

Descriptive Statistics

Mean overall errors, mean decision errors, and mean of suspect measures and procedural errors per file of students classified as learning disabled during post-intervention period are presented for experimental and comparison groups in Figure 5, 6, and 7 respectively. Following intervention, the difference of mean overall errors between groups were 4.49 errors per student file, with an average of 0.18 errors per student file in the experimental group and an average of 4.67 errors per student file in the comparison group. Figure 6 shows a marked difference of mean decision errors (0.33 errors per student file) between experimental (0.11 errors per student file) and comparison (0.44 errors per student file) groups. The mean errors of suspect measures and procedural errors are presented in Figure 7. The mean errors per student file for the experimental group was 0.08 as compared to 4.22 errors per student file for the comparison group. Further analyses of the different types of errors per student files are displayed by individual schools in experimental groups in Figures 8, 9, 10, and 11. Data show that the files of students that were classified as LD during the post intervention had a smaller number of errors than those previously assessed.

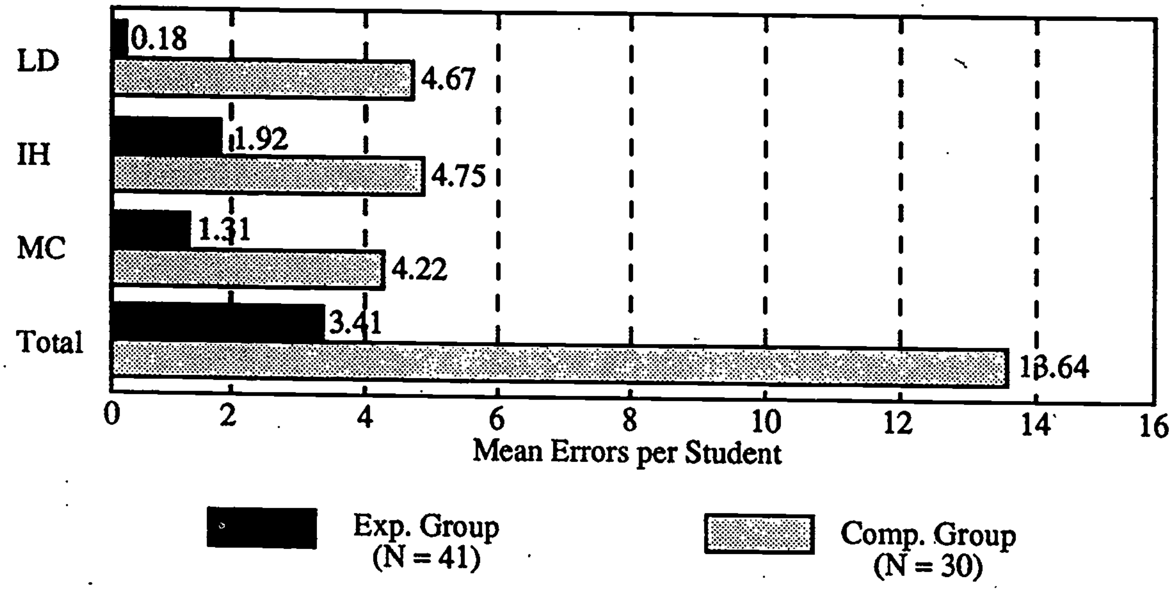


Figure 5. Post-Intervention Data: Mean Overall Errors between Experimental and Comparison Group.

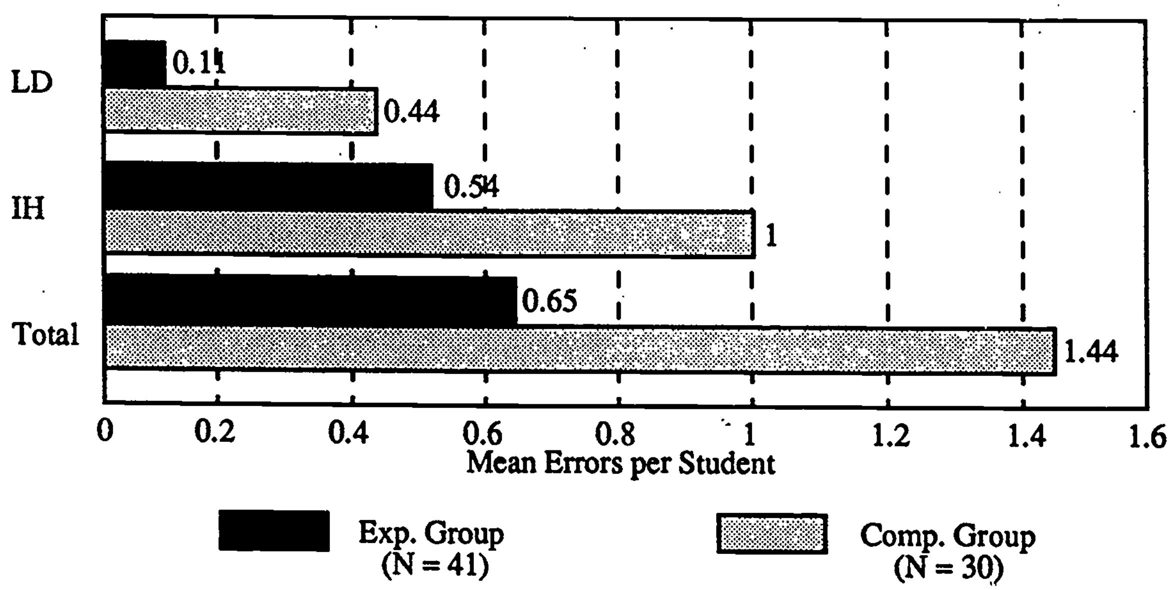


Figure 6. Post-Intervention Data: Mean Decision Errors between Experimental and Comparison Group.

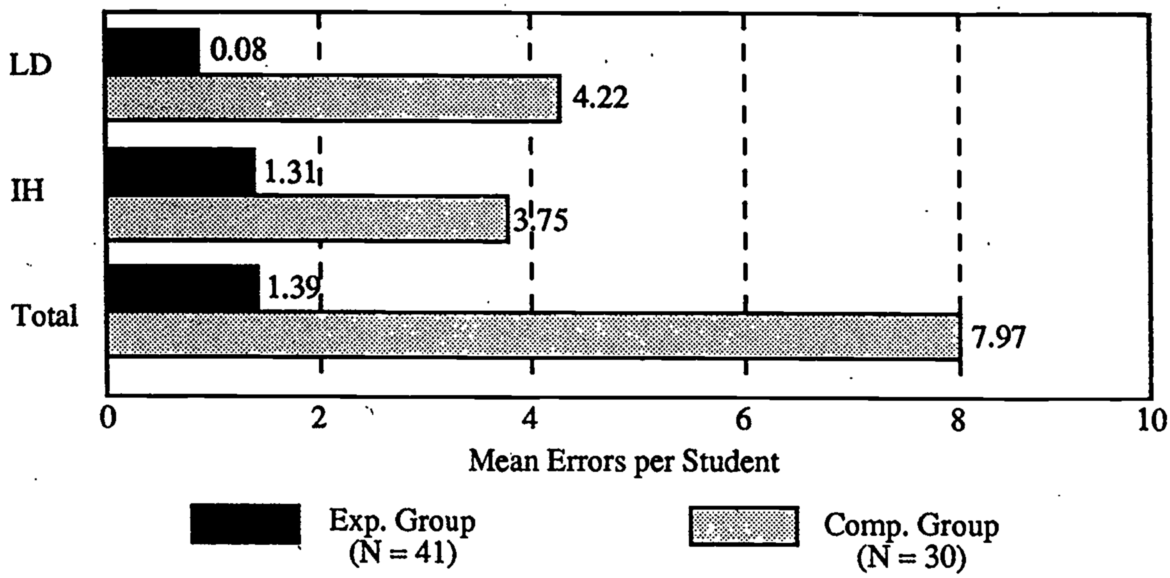


Figure 7. Post-Intervention Data: Mean Errors of Suspect Measures and Procedural Errors between Experimental and Comparison Group.

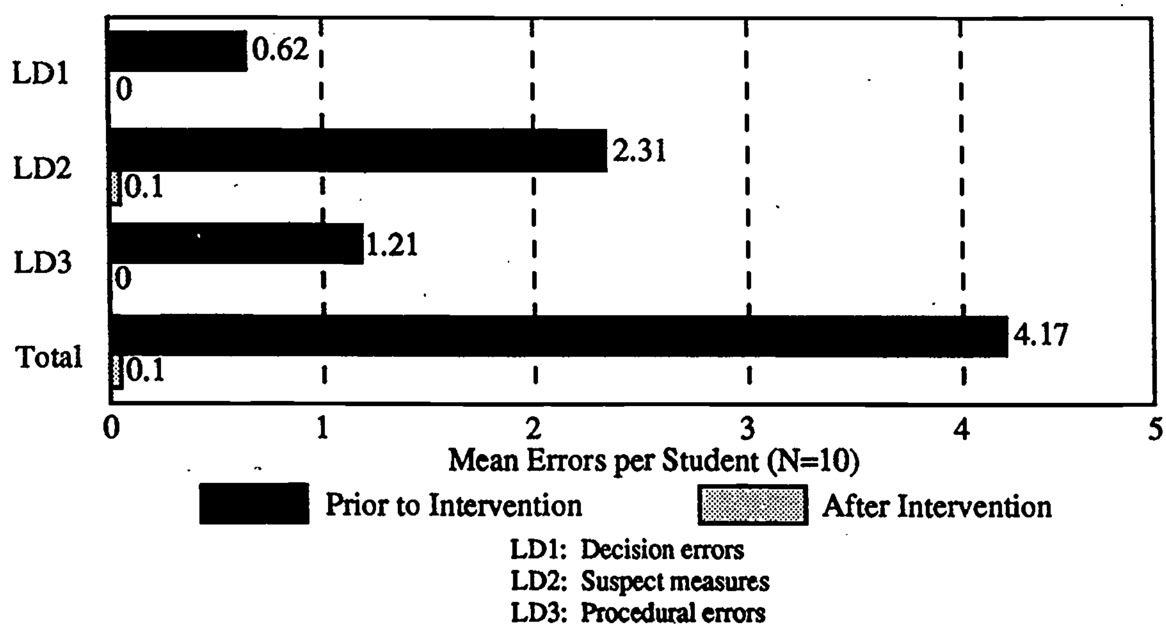
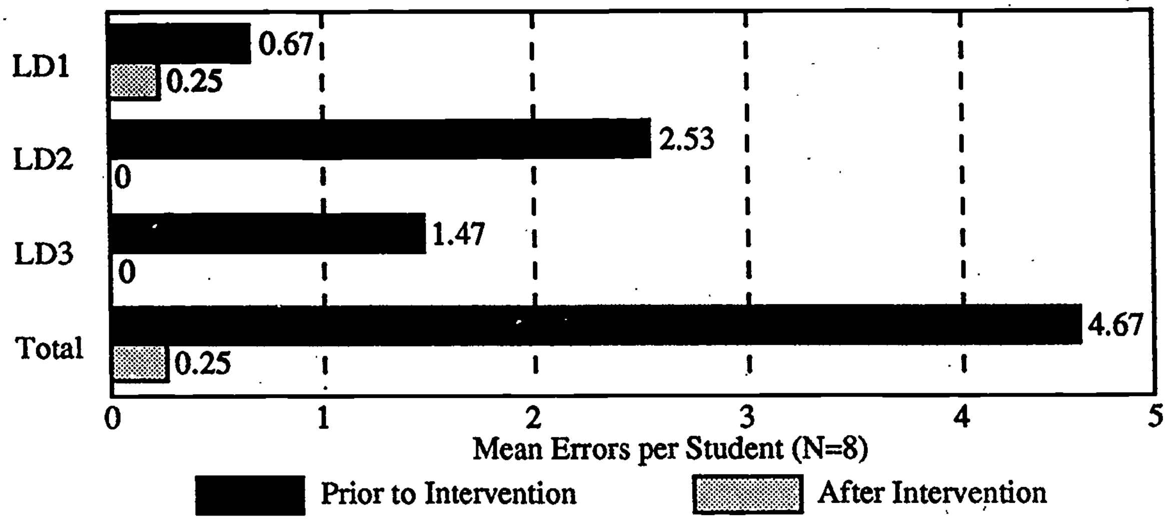
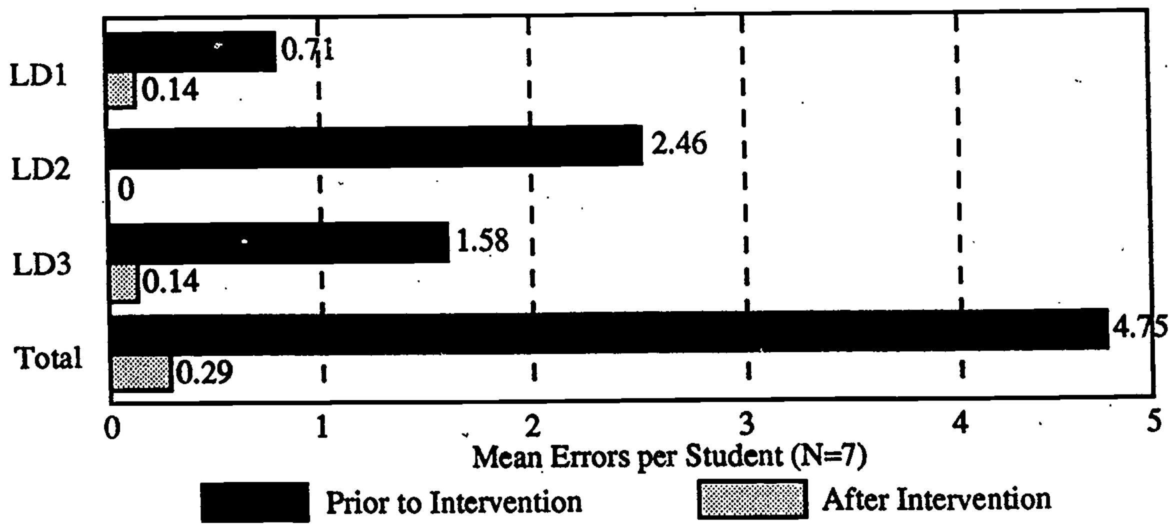


Figure 8. Mean Errors per LD Student from School 1.



LD1: Decision errors
LD2: Suspect measures
LD3: Procedural errors

Figure 9. Mean Errors per LD Student from School 2.



LD1: Decision errors
LD2: Suspect measures
LD3: Procedural errors

Figure 10. Mean Errors per LD Student from School 3.

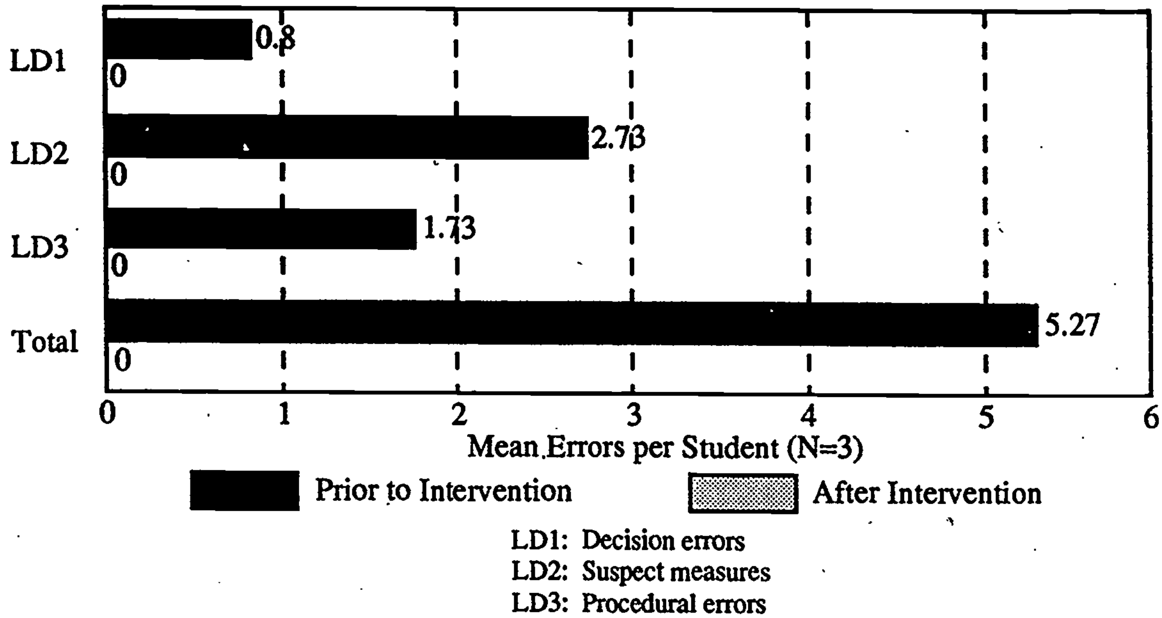


Figure 11. Mean Errors per LD Student from School 4.

The numbers of mean errors and associated standard deviations for the experimental and comparison group during pre- and post-interventions are presented in Table 7 and 8 respectively. Prior to the intervention, the experimental group averaged 4.63 overall errors per student file. The overall errors dropped to an average of 0.18 per student file during the post-intervention, a statistically significant decrease of 4.44 errors per student file. The number of overall

Table 7.

Pre- and Post- Intervention Data Analysis for Experimental Group

Dependent Variables	Pre-intervention		Post-intervention		Effect Size	p-value
	Mean	SD	Mean	SD		
Learning Disabilities						
Overall Errors	4.63	2.60	0.18	0.39	-1.71	0.000*
Decision Errors	0.69	0.76	0.11	0.32	-0.76	0.001*
Suspect Measures	2.47	1.40	0.04	0.19	-1.74	0.000*
Procedural Errors	1.46	0.90	0.04	0.19	-1.58	0.000*

Table 8.

Pre- and Post- Intervention Data Analysis for Comparison Group

Dependent Variables	Pre-intervention		Post-intervention		Effect Size	p-value
	Mean	SD	Mean	SD		
Learning Disabilities						
Overall Errors	4.94	1.59	4.67	1.46	-0.17	0.555
Decision Errors	0.58	0.67	0.44	0.51	-0.20	0.473
Suspect Measures	2.80	0.83	2.61	0.61	-0.23	0.418
Procedural Errors	1.58	0.73	1.61	0.78	0.04	0.872

errors for the comparison group remained approximately the same with the average number dropping from 4.94 (pre) to 4.67 (post), a decrease of 0.27 errors per file. The mean decision errors for the experimental group also dropped from 0.69 to 0.11 after intervention, a statistically significant decrease of 0.58 errors. In the comparison group, the number of decision errors remained unchanged, with 0.58 errors (pre) and 0.44 errors (post).

As indicated in Table 7, the number of suspect measures for the experimental group significantly decreased from an average of 2.47 (pre) to 0.04 (post), an average decrease of 2.43 errors per file. The suspect measures for the comparison group remained relatively constant (see Table 8) from pre- to post-intervention.

Finally, as indicated in Table 7, there was a significant reduction in the number of procedural errors per student file for the experimental group after intervention. The number of errors dropped from 1.46 to 0.04 per student file, a significant decrease of 1.42 procedural errors per student file. The number of procedural errors in the comparison group remained unchanged from pre- to post-intervention with the average number increasing from 1.58 to 1.61 errors.

Evaluation Question 1.2: Relative to pre-implementation, did the IASP process result in a reduction of the number of decision errors in classification of learning disabled students?

Assumptions of the Chow Test: Analyses were performed to examine the assumptions (i.e., linearity, homogeneity of variance, normality, and independence of errors) of the regression procedure underlying the Chow statistic used in this study. The assumptions of linearity and homogeneity were examined by plotting the residuals against the predicted values and also against the independent variables. Corresponding graphs can be found in Appendix E. In both plots there were relatively unsystematic patterns to the spread of the residuals, indicating that the assumptions of linearity and homogeneity of variance were met. The assumption of normality was checked by plotting the distribution of the residuals. The distribution of the residuals appeared to be fairly normal, indicating that the assumption of normality was met. Another assumption of independence of errors was checked by plotting the residuals against the sequence variable. There was not systematic pattern in those plots, indicating that the assumption of independence of errors was met.

Statistical significance. The Chow Test analyses of the effect of the IASP on overall errors is presented in Table 9.

Table 9.

Analysis of the effect of the IASP on the classification of students with handicaps in Ogden School District.

Dependent Variables Learning Disabilities	Experimental Group				Comparison Group			
	Intercept		Slope		Intercept		Slope	
	t	p	t	p	t	p	t	p
Overall Errors	-4.916	0.000*	0.071	0.943	1.381	0.172	1.151	0.254
Decision Errors	-2.597	0.011*	-0.132	0.895	0.784	0.436	0.040	0.968
Suspect Measures	-4.686	0.000*	0.316	0.753	1.535	0.130	0.410	0.968
Procedural Errors	-4.591	0.000*	-0.154	0.878	0.421	0.675	-1.862	0.067

The table presents the t-values for the intercept (i.e., reduction of the number of errors between pre- and post-intervention) and slopes (i.e., changes in the trend of errors across time between pre- and post-intervention) associated with the number of overall errors in classification of students with learning disablities. As indicated in Table 9, the effect of the IASP was significant with intercept ($t = -4.916$; $p = 0.000$), but insignificant with slope ($t = 0.071$; $p = 0.943$) at the probability level of .05 for the experimental group. These results show that there was a statistically significant reduction of the number of overall errors between the regression lines of pre- and post-intervention for the experimental group. However, the trend of the regression line prior to intervention was similar to the trend of the regression line after intervention. In the comparison group, both intercept ($t = 1.381$; $p = 0.172$) and slope ($t = 1.151$; $p = 0.254$) of the number of overall errors were statistically insignificant at the .05 level.

Educational significance. To evaluate educational significance, effect sizes were calculated. Table 7 displays the effect sizes (ES) between pre- and post- mean overall errors in the experimental group. Results indicated that there was a statistically significant reduction of the mean of overall errors (ES = -1.71; p = 0.000) at the .05 level between pre- and post-intervention. Thus, the mean number of overall errors after intervention dropped approximately two standard deviations below the errors prior to intervention. A similar reduction did not occur in the comparison group (ES = -0.17; p = 0.555) (see Table 8).

Statistical Significance. An analysis of the effect of the IASP on decision errors based on the Chow test is presented in Table 9. Data from Table 9 indicate that the reduction of decision errors between pre- and post-intervention for the experimental group was significant with intercept (t = -2.597; p = 0.011) and the change of the trend of decision errors across time between pre- and post-intervention was insignificant with slope (t = -0.132; p = 0.895) at the .05 level. Therefore, although there was a statistically significant reduction in the number of decision errors between the regression lines of pre- and post- intervention for the experimental group, there was no statistical significance between the pre and post trend lines. In the comparison group, both intercept and slope were statistically insignificant at the .05 level. That is, the number of decision errors per student file failed to decrease or increase in the comparison group and the trend of decision errors remained constant across time.

Educational Significance. The analysis of the effect of the IASP between pre- and post-mean decision errors is presented with effect sizes in Table 7. Effect sizes in the experimental group showed a statistically significant reduction of mean decision errors between pre- and post-intervention (ES = -0.76; p = 0.001). This result indicates that the mean number of decision errors dropped to approximately one standard deviation following intervention. For educational research the difference is significant at the .001 level. Data in Table 8 show that there was a small reduction of mean decision errors between pre- and post- intervention in the comparison group.

Evaluation Question 1.3: Relative to pre-implementation, did the IASP process result in a reduction of the number of suspect measures in classification of iearning disabled students?

Statistical significance. The Chow test analysis of the effect of the IASP on suspect measures is presented in Table 9. The table presents the t-values for the intercept and slopes associated with the number of suspect measures in classification of learning disabled students. Data show that the reduction of suspect measures between pre- and post-intervention for the experimental group was significant, and the change in the trend between pre- and post-intervention was insignificant with slope at the .05 level. A similar reduction in the number of suspect measure errors was not noted for the comparison group.

Educational significance. As shown by the effect sizes in Table 7, there was a statistically significant reduction of mean suspect measures between pre- and post-intervention (ES = -1.74; p = 0.000) at the probability level of .05 in the experimental group. This result indicates that the mean number of errors dropped approximately two standard deviations below mean errors prior to intervention, an educationally significant difference. The reduction in mean errors of suspect measures between pre- and post-intervention for the comparison group was not significant at the .05 level.

Evaluation Question 1.4: Relative to pre-implementation, did the IASP process result in a reduction of the number of procedural errors in classification of learning disabled students?

Statistical significance. An analysis of the effect of the IASP on procedural errors between per- and post- intervention based on the Chow test is presented in Table 9. In the experimental group, the reduction of procedural errors between pre- and post-intervention was significant with intercept (t = -4.591; p = 0.000) and the change of the trend of procedural errors across time was insignificant with slope (t = 0.421; p = 0675) at the .05 level. Both the intercept (t = 0.421; p = 0.675) and slope (t = -1.862; p = 0.067) were statistically insignificant at the .05 level for the comparison group. That is, the number of procedural errors failed to decrease or increase, and the trend of procedural errors was relatively consistent across time.

Educational significance. In Table 7, the results indicate that there was a statistically significant reduction of mean procedural errors between pre- and post-intervention (ES = -1.58; p = 0.000) for the experimental group at the .05 probability level, an educationally significant difference. As Table 8 shows, there was not a similar reduction in procedural errors from pre- to post-intervention for the comparison group.

Intellectually Handicapped

Descriptive Statistics

Mean overall errors, mean decision errors, and mean of suspect measures and procedural errors per file of student classified as intellectually disabled are presented for experimental and comparison groups in Figure 12, 13, and 14 respectively. Following intervention, the difference of mean overall errors between groups was 2.83 errors per student file, with the experimental group averaging 1.92 errors as compared to the comparison group with an average of 4.75

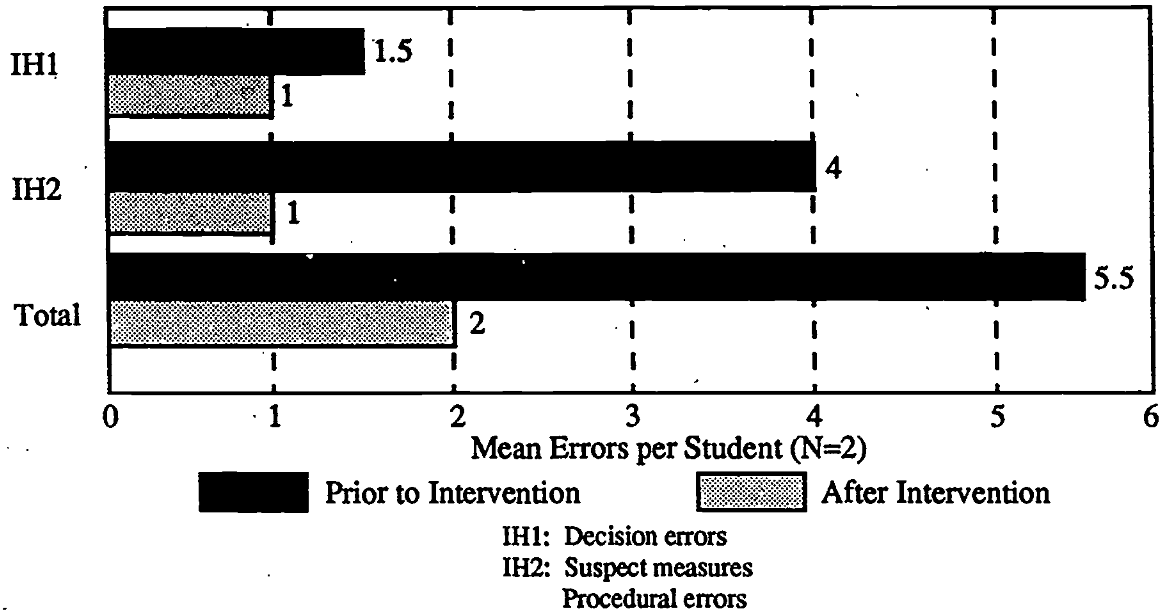


Figure 12. Mean Errors per IH Student from School 1.

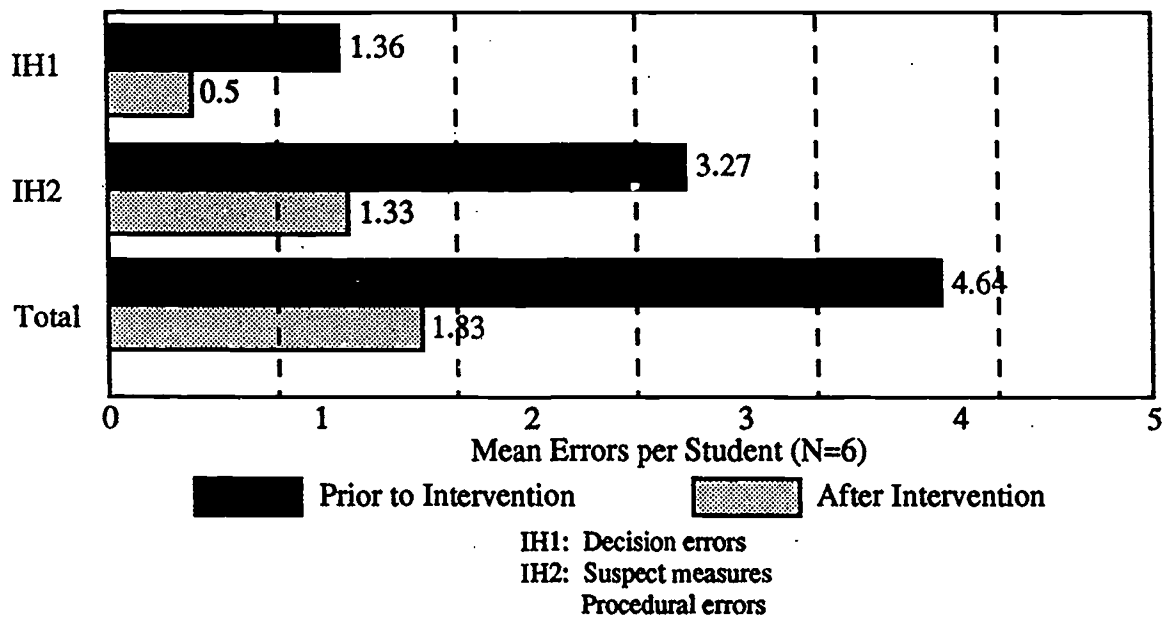


Figure 13. Mean Errors per IH Student from School 2.

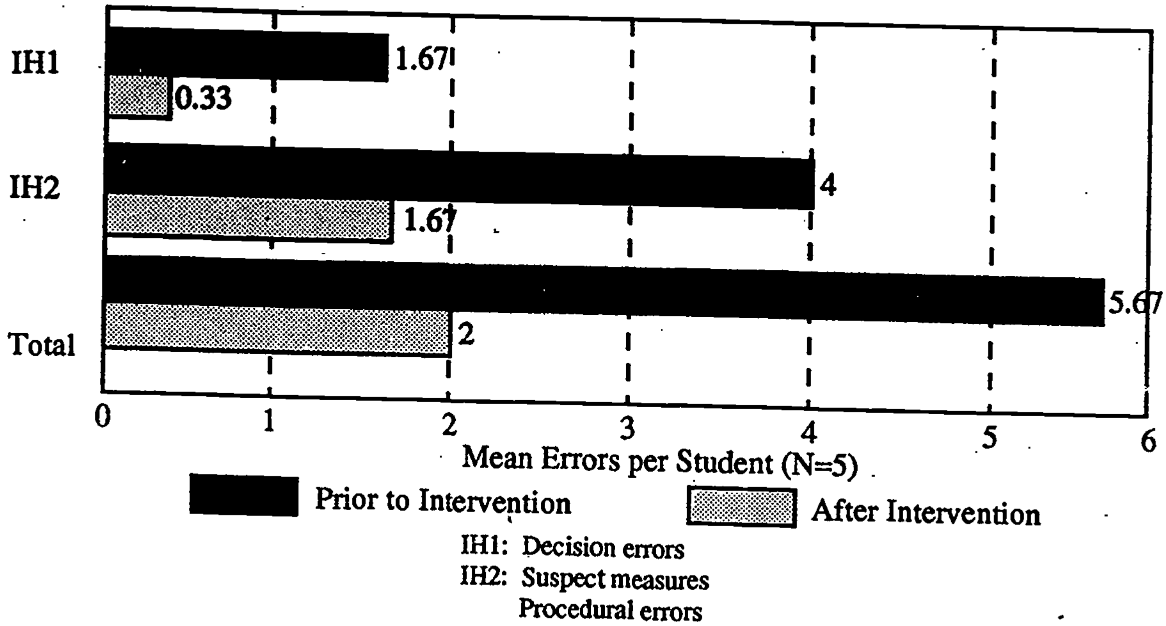


Figure 14. Mean Errors per IH Student from School 3.

errors. As noted in Figure 13, there was a significant difference of mean decision errors (0.46 errors per student file) between experimental (0.54 errors per student file) and comparison (1.00 errors per student file) groups. Similarly, the mean errors of suspect measures and procedural errors of the experimental group (1.31 errors) are significantly less than those of comparison group (3.75 errors) (see Figure 14).

Further analyses of the different types of errors per student files are graphically displayed by school in Figure 15, 16, and 17. These figures present the differences of mean errors between pre- and post-intervention in the experimental schools. A decrease in errors was reported in all four schools. As noted earlier, there were no students who were newly classified as intellectually disabled in School 4 during the post-intervention period, therefore, School 4 was not included.

Mean errors and associated standard deviations of pre- and post-interventions are presented for the experimental and comparison group in Table 10 and 11, respectively. Prior to intervention, the experimental group averaged 4.81 overall errors per student file. Overall errors then dropped to an average of 1.92 during post-intervention, a statistically significant decrease of 2.89 errors per student file (see Table 10). As indicated in Table 11, the number of overall errors per file in the comparison group remained approximately the same, dropping from 5.00 to 4.75.

Mean decision errors for the experimental group dropped from 1.41 to 0.54 per student file after intervention, a statistically significant decrease of 0.87 decision errors per student file. Again, the number of decision errors remained approximately the same for the comparison group.

Table 10.

Pre- and Post- Intervention Data Analysis for Experimental Group

Dependent Variables	Pre-intervention		Post-intervention		Effect Size	p-value
	Mean	SD	Mean	SD		
Intellectually Disabled						
Overall Errors	4.81	1.52	1.92	0.64	-1.90	0.000*
Decision Errors	1.41	1.08	0.54	0.52	-0.80	0.022*
Suspect Measures with data & Procedural Errors	3.41	1.01	1.31	0.48	-2.08	0.000*

Table 11.

Pre- and Post- Intervention Data Analysis for Comparison Group

Dependent Variables	Pre-intervention		Post-intervention		Effect Size	p-value
	Mean	SD	Mean	SD		
Intellectually Disabled						
Overall Errors	5.00	1.73	4.75	1.60	-0.14	0.700
Decision Errors	1.37	1.26	1.00	0.95	-0.29	0.439
Suspect Measures with data & Procedural Errors	3.63	0.76	3.75	1.14	0.16	0.679

Data in Table 10 show that the number of suspect measures and procedural errors for the experimental group significantly decreased to 2.10 errors per student file. As indicated in Table 11, the number of errors in the comparison group increased from 3.63 (pre) to 3.75 (post).

Evaluation Question 2.1: Relative to pre-implementation, did the IASP process result in a reduction of the number of overall errors in classification of intellectually disabled students?

Statistical significance. The Chow test analyses of the effect of the IASP on overall errors is presented in Table 12. The effect of the IASP was significant with intercept ($t = -2.961$; $p = 0.005$), but insignificant with slope ($t = 0.059$; $p = 0.953$) at the probability level of 0.05 for the experimental group. In the comparison group, both intercept ($t = 0.204$; $p = 0.840$) and slope ($t = 0.216$; $p = 0.831$) of the number of overall errors were statistically insignificant at the .05 level. Results suggest that while the number of overall errors decreased significantly in the experimental group, a corresponding deduction in the overall errors did not occur in the comparison group.

Educational significance. Effect sizes of mean overall errors in the experimental group across pre- and post-intervention are included in Table 10. Based on the results, the mean overall errors in the experimental group was reduced approximately two standard deviations from pre- to post-intervention. A similar reduction was not noted in the comparison group (see Table 11).

Table 12.

Analysis of the effect of the IASP on the classification of handicapped students in Ogden School District.

Dependent Variables Intellectually Disabled	Experimental Group				Comparison Group			
	Intercept		Slope		Intercept		Slope	
	t	p	t	p	t	p	t	p
Overall Errors	-2.961	0.005*	0.059	0.953	0.204	0.840	0.216	0.831
Decision Errors	-1.595	0.119	0.723	0.474	-0.323	0.749	0.632	0.535
Suspect Measures with Data & Procedural Errors	-2.996	0.005*	-0.223	0.825	0.780	0.442	-0.395	0.696

Evaluation Question 2.2: Relative to pre-implementation, did the IASP process result in a reduction of the number of decision errors in classification of intellectually disabled students?

Statistical significance. An analysis of the effect of the IASP on decision errors based on the Chow test is presented in Table 12. Results indicate that a reduction of decision errors between pre- and post-intervention was insignificant with intercept ($t = -1.595$; $p = 0.119$) for the experimental group. Further, the change of the trend of decision errors across time between pre- and post-intervention was also insignificant with slope. These findings sharply contrast with the previous results. A number of possible explanations exist.

First, the Chow test is generally conservative (Kmenta, 1986), and although there was a decrease in decision errors (see Table 11), the reduction was insufficient in light of the conservative requirements of the statistic. Second, there were a number of overriding decisions that occurred throughout the consultation (e.g., high adaptive score compared to low IQ, borderline IQ or vision and/or hearing problem, etc.). Consequently, it could be said that the expert system accounted for a number of potential decision errors in the experimental group which do not appear as a part of the data. The number of decision errors per student file in the comparison group failed to decrease or increase, and the trend of decision errors was consistent across time.

Educational significance. The analysis of the effect of the IASP between pre- and post-mean of decision errors and corresponding effect sizes are presented Table 10. In the experimental group, there was a statistically significant reduction of mean decision errors between pre- and post-intervention at the 0.05 level. Mean decision errors dropped an average of one standard deviation from pre- to post-intervention, an educationally significant finding. As indicated in Table 11 a similar reduction of mean decision errors did not occur in the comparison group.

Evaluation Question 2.3: Relative to pre-implementation, did the IASP process result in a reduction of the number of suspect errors and procedural errors in classification of intellectually disabled students?

Statistical significance. Table 12 presents the T-values for the intercept and slopes associated with the number of suspect measures and procedural errors in classification of intellectually disabled students. The experimental group had a statistically significant reduction of suspect measures and procedural errors between pre- and post-intervention, as indicated by the intercept. The change in the trend between pre- and post-intervention was insignificant at the .05 level. In the comparison group, both intercept and slope were statistically insignificant at the 0.05 level.

Educational significance. The analysis of the effect of the IASP on the number of suspect measures and procedural errors is presented with effect sizes in Table 10. Statistically significant effect sizes in the experimental group indicate that the mean numbers of suspect measures and procedural errors dropped more than two standard deviations from pre- to post-intervention an educationally significant improvement in teacher's performance in the experimental schools. The reduction of suspect measures and procedural errors in the comparison group was negligible.

IEP Procedures

Evaluation Question 3.1: Relative to pre-implementation, did the IASP process result in a reduction of the number of overall compliance errors with federal and state mandated IEP procedures?

Descriptive Statistics

Figure 15 presents the mean of total compliance errors (i.e., errors prior to the IEP meeting, errors associated with the development of the IEP documents for experimental and comparison groups during post-intervention period). Following intervention, the difference between groups were a mean of 2.91 compliance errors per student file, with an average of 1.31 errors in the experimental group and 4.22 in the comparison group. There was a significant difference of mean errors prior to IEP meeting between experimental (0.5 errors) and comparison (1.44 errors) groups. A similar pattern between the experimental and control group performance can be seen for mean errors associated with IEP meeting and IEP document.

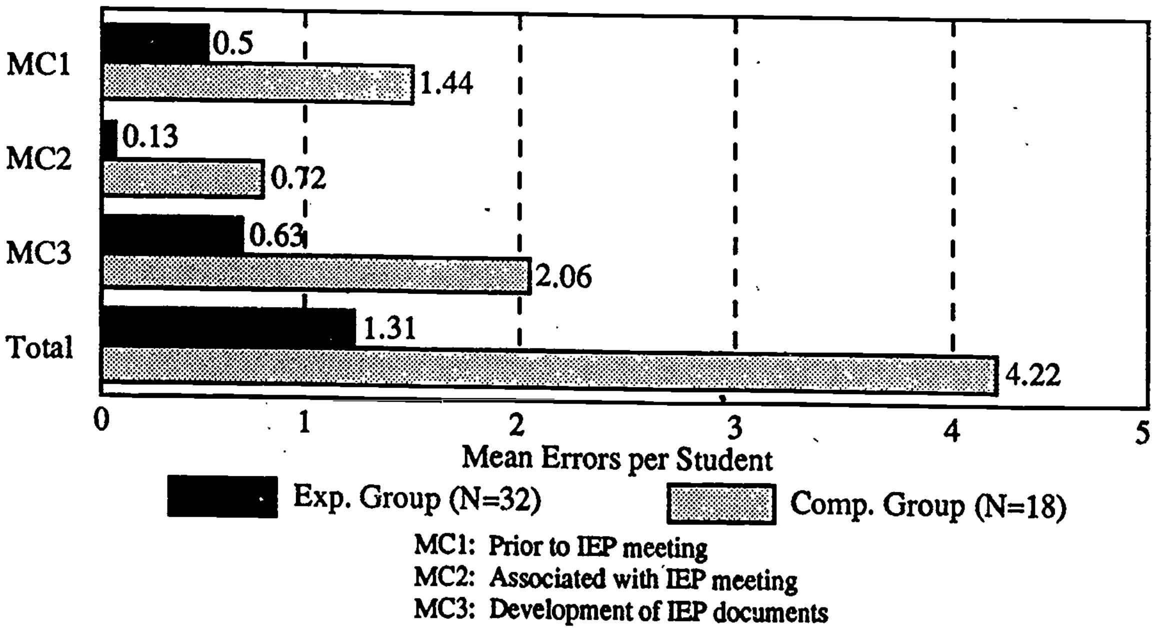


Figure 15. Mean Errors between Experimental and Comparison Group.

Further analyses of the different types of errors per student files are graphically displayed by school in the experimental group in Figures 16, 17, 18, and 19. Data indicate that schools in the experimental group reduced the number of compliance errors by half from pre- to post-intervention.

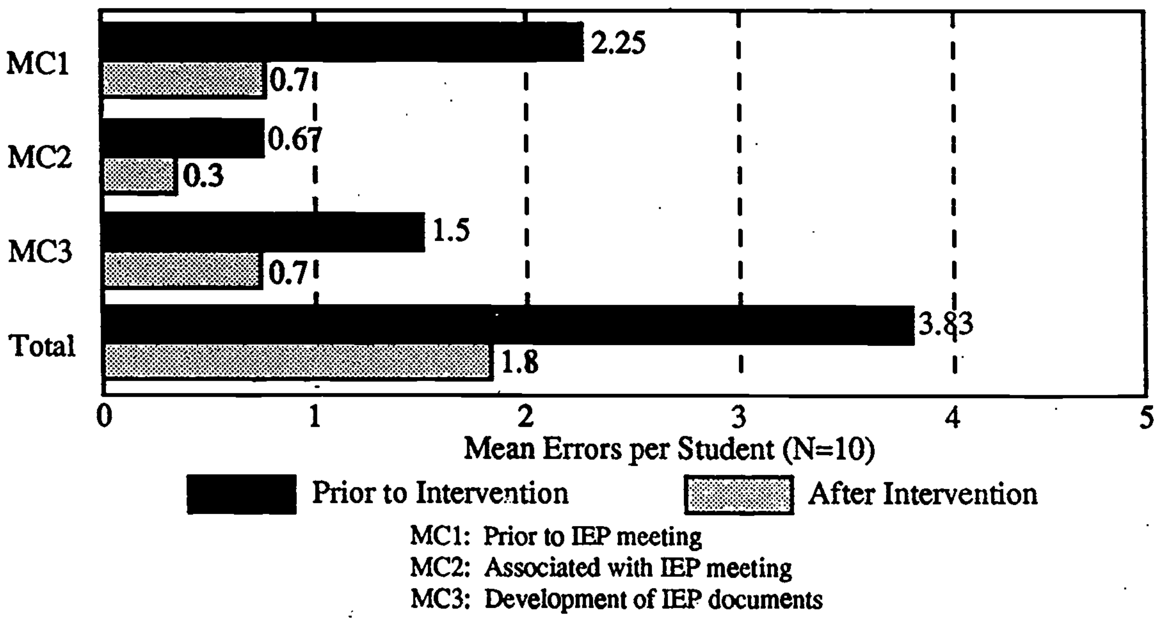


Figure 16. Mean Errors per Student from School 1.

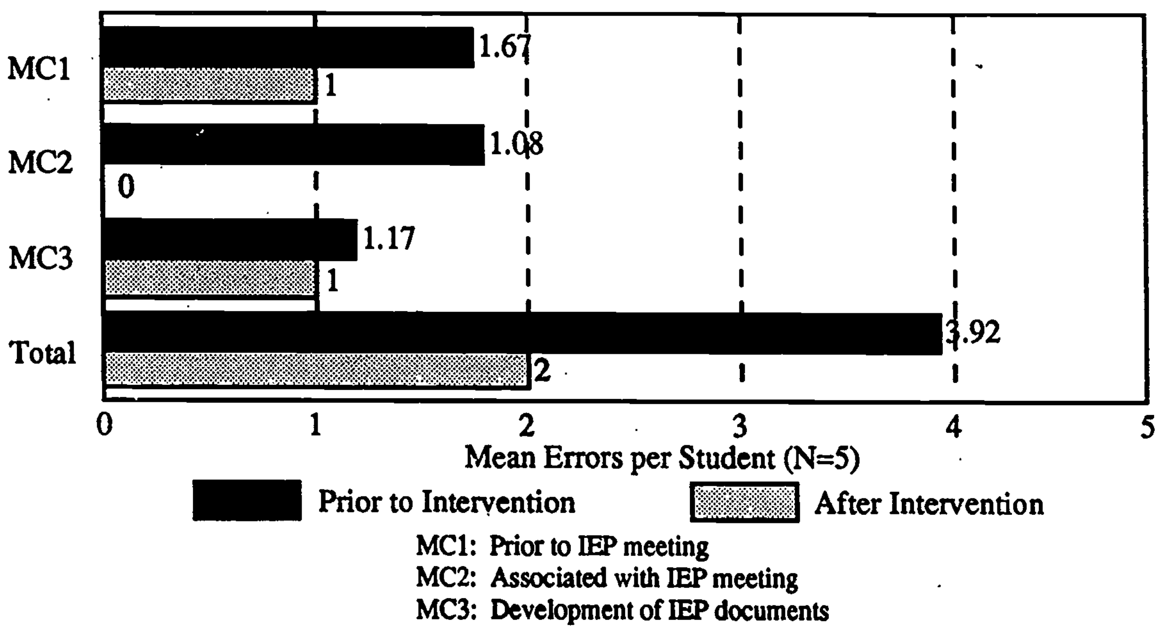


Figure 17. Mean Errors per Student from School 2.

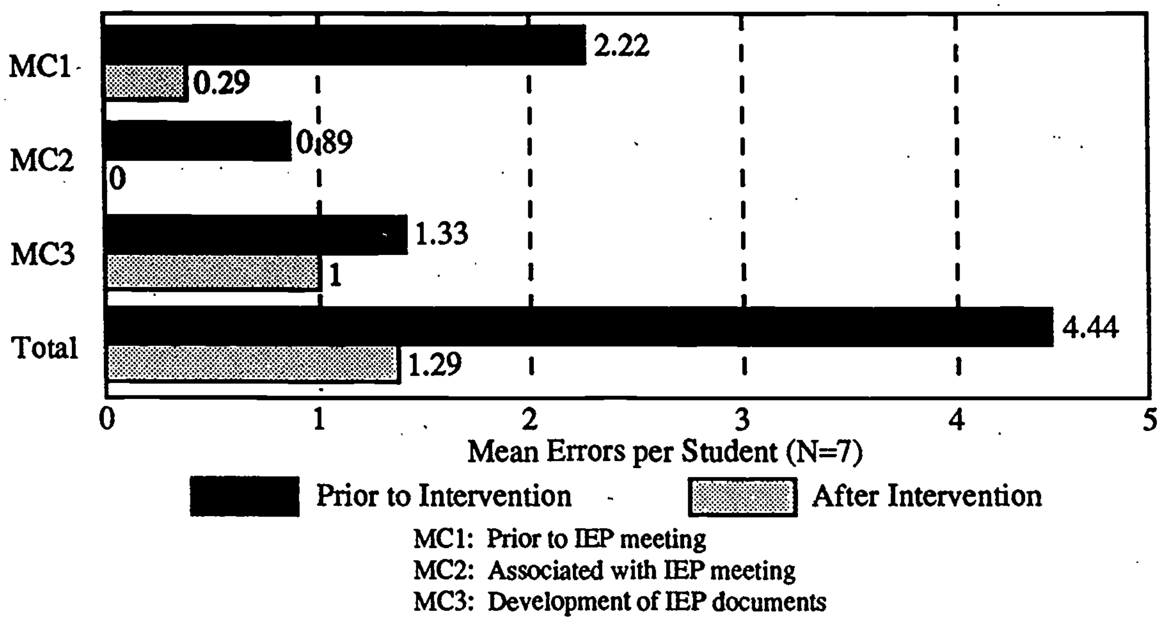


Figure 18. Mean Errors per Student from School 3.

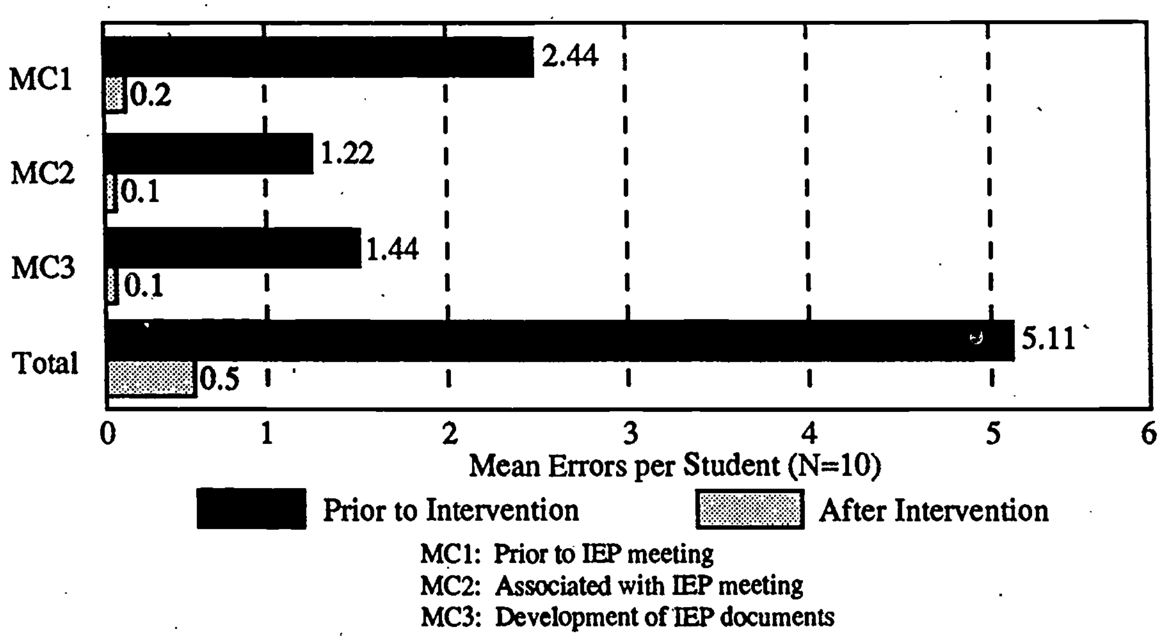


Figure 19. Mean Errors per Student from School 4.

Mean errors and associated standard deviations for pre- and post-intervention are presented for experimental and comparison group in Tables 13 and 14 respectively. Prior to the intervention, the experimental group averaged 4.26 overall compliance errors per student file.

Table 13.

Pre- and Post- Intervention Data Analysis for Experimental Group

Dependent Variables	Pre-intervention		Post-intervention		Effect Size	p-value
	Mean	SD	Mean	SD		
Mandate Consultant						
Overall Errors	4.26	1.36	1.31	0.78	-2.16	0.000*
Problems prior to IEP meeting	2.12	0.83	0.50	0.51	-1.95	0.000*
Problems associated with IEP meeting	0.95	0.54	0.13	0.34	-1.54	0.000*
Problems associated with the development of IEP documents	1.36	0.58	0.63	0.49	-1.27	0.000*

Table 14.

Pre- and Post- Intervention Data Analysis for Comparison Group

Dependent Variables	Pre-intervention		Post-intervention		Effect Size	p-value
	Mean	SD	Mean	SD		
Mandate Consultant						
Overall Errors	4.27	1.25	4.22	1.21	-0.04	0.892
Problems prior to the IEP meeting	1.61	0.91	1.44	0.78	-0.18	0.534
Problems associated with the IEP meeting	0.73	0.63	0.72	0.57	-0.01	0.957
Problems associated with the development of IEP documents	1.98	0.65	2.06	0.53	0.12	0.670

The overall errors then dropped to an average of 1.31 per student file during the post-intervention, a statistically significant decrease of 2.95 errors. Performance of the comparison group remained the same from pre- to post-intervention.

In the experimental group, the mean number of errors prior to the IEP meeting were reduced from 2.12 errors (pre) to .05 (post), a statistically significant decrease of 1.61 errors (see Table 13). Performance of the comparison group remained unchanged (see Table 14).

The mean number of errors associated with the development of the IEP document for the experimental group dropped from an average of 1.36 errors (pre) to 0.63 (post) (see Table 13). As indicated in Table 14, the average number of errors in the comparison group increased slightly from 1.98 errors (pre) to 2.06 errors (post) per student file.

Finally, Table 13 shows that the number of errors associated with IEP meetings for the experimental group dropped from 0.95 errors to 0.13 errors per student file, a significant decrease of 0.82. The number of errors in the comparison group remained relatively constant.

Statistical significance. The Chow test analyses of the effect of the IASP on overall compliance errors is presented in Table 15. As Table 15 shows, the effect of the IASP was significant with intercept (t = -3.744; p - 0.004), but insignificant with slope (t = 0.207; p = 0.836) at the .05 level for the experimental group. In the comparison group, the reduction in overall compliance errors was statistically insignificant at the .05 level.

Table 15.

Analysis of the effect of the IASP on the classification of handicapped students in Ogden School District.

Dependent Variables Mandate Consultant	Experimental Group				Comparison Group			
	Intercept		Slope		Intercept		Slope	
	t	p	t	p	t	p	t	p
Overall Errors	-3.744	0.004*	0.207	0.836	0.515	0.608	-0.314	0.754
Problems prior to the IEP meeting	-2.915	0.005*	0.612	0.542	1.179	0.243	1.133	0.262
Problems associated with IEP meeting	-2.011	0.048*	0.014	0.989	-0.124	0.902	-1.094	0.279
Problems associated with development of IEP documents	-2.993	0.004*	-1.025	0.309	-0.138	0.891	-0.912	0.366

Educational significance. The Effect Sizes (ES) between pre- and post-mean overall errors in the experimental group are displayed in Table 13. There was a statistically significant reduction of overall IEP compliance errors (ES = -2.16; p = 0.000) at the .05 level with errors dropping an average of more than two standard deviations from pre- to post-intervention. As Table 14 indicates, the reduction of overall errors for the comparison group was negligible (ES = -0.04; p = 0.892).

Evaluation Question 3.2: Relative to pre-implementation, did the IASP process result in a reduction of the number of errors prior to the IEP meeting with federal and state mandated IEP procedures?

Statistical significance. Table 15 presents the t-values for the intercept and slopes associated with the number of IEP procedural errors prior to the IEP meeting. In the experimental group, the reduction of errors prior to the IEP meeting between pre- and post-intervention was significant with intercept. However, the change of the trend of errors across time (pre- and post-intervention) was insignificant with slope at the .05 level. In the comparison group, both intercept (t - 1.179; p = 0.243) and slope (t = 1.133; p = 0.262) were statistically insignificant.

Educational significance. The analysis of the effect of the IASP on errors prior to the IEP meeting is presented with effect sizes in Table 13. Effect sizes for the experimental group were statistically significant between pre- and post-intervention (ES = -1.95; p = 0.000) at the .05 level. In the experimental group, mean procedural errors prior to the IEP meeting dropped an average of almost two standard deviations from pre- to post-intervention, a substantial decrease at the (0.000) level. As Table 14 shows, a similar reduction of errors between pre- and post-intervention was not noted in the comparison group (ES = -0.18; p = 0.534).

Evaluation Question 3.3: Relative to pre-implementation, did the IASP process result in a reduction of the number of errors associated with the development of the IEP document with federal and state mandated IEP procedures?

Statistical significance. The Chow test analyses of the effect of the IASP are presented in Table 15. The data in Table 15 reveals a similar pattern to the previous data. The number of errors associated with the IEP document in the experimental group were greatly reduced from pre to post-intervention although the change in the trend was insignificant with slope at the .05 level. In the comparison group, reduction of the number of errors associated with the IEP documents were statistically insignificant at the .05 level.

Educational significance. As shown in Table 13, effect sizes in the experimental group were statistically significant between pre- and post-intervention (ES = -1.54; p = 0.000) at the

.05 level. Results for the comparison group were not statistically significant (ES = -0.01; p = 0.957) (see Table 14).

Evaluation Question 3.4: Relative to pre-implementation, did the IASP process result in a reduction of the number of errors associated with the mandated procedures in IEP meeting.

Statistical significance. An analysis of the effect of the IASP based on the Chow test is presented in Table 15. The findings in Table 15 are consistent with the previous data. The reduction of errors associated with the IEP meeting between pre- and post-intervention was significant at the .05 level for the experimental group but not for the comparison group.

Educational significance. Effect sizes in the experimental group indicate that there was a statistically significant reduction of mean errors associated with the IEP meeting (ES = -1.27; p = 0.000), (see Table 13). A similar reduction of mean errors was not noted in the comparison group (ES = 0.12; p = 0.67).

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Research shows that many educators continue to have difficulty (1) interpreting and applying special education rules and regulations (2) determining eligibility for special education, and (3) developing IEPs. Such problems may prove costly--children in need of special education may fail to receive the services they require, other children not requiring services may be inappropriately classified and served, thus wasting precious special education resources. Clearly, school administrators, teachers, parents, and children would benefit if there were an objective, knowledgeable expert in the field to assure that federal and state mandated procedures were being implemented as intended.

In recent years, expert systems have been developed in the areas of medicine, geology, and engineering as a means of capturing specific domains of human expertise and making that knowledge available to inexperienced individuals. Most recently, researchers at Utah State University have successfully applied the technology of expert systems to the area of federal regulations and state rules for special education. These researchers developed and validated several expert systems including (1) Class.LD2, (2) Class.IH, (3) Class.BD, and (4) Mandate Consultant. Results of validation studies and replications have been consistent with the findings of other special education researchers (Colbourn & McLeod, 1983; Haynes, J. A., Pilato, V. H., & Malouf, D. B., 1987). Together, these studies support the following conclusions;

1. Expert systems can be developed to substantially enhance decision-making in special education.
2. Based on research conducted to date, expert systems technology appears well-suited to decision-making in special education.
3. Expert systems can serve multiple functions (e.g., decision maker, inservice trainer) which considerably increases their cost-effectiveness.

Given the well-documented interest in computerized, information management systems, the demonstrated effectiveness of the expert systems to enhance decision making, and the present investment in several expert systems, the development of a comprehensive information management system was feasible and necessary.

The primary purpose of the present study was the development and initial validation of a computerized information system that used expert system technology. To meet this purpose, the Intelligent Administrative Support Program (IASP) incorporated existing expert systems (i.e., Class.LD2, Class.IH, Mandate Consultant) with a central special education data base.

Specifically, the program was designed to assist special education administrators in the acquisition and management of information regarding on-going staff training needs.

The development of the computerized management system followed a Research and Development (R & D) model consisting of four phases. The first three phases emphasized formative evaluation. They included:

1. Content clarification and system design: During this phase, a group of professionals met on several occasions to determine the objectives for the development of the system and to clarify who would use the program, how the program would be used, and what type of output would be most useful in evaluating staff needs.
2. Development and field test of the prototype and revisions: In this phase, several prototypes were developed and then tested and revised until it produced reliable and functional output. Several meetings were held with district staff to review output results and to revise the format of the system's summary report to facilitate understanding.

The third phase of the R & D model involved a summative evaluation of the computerized information management system. An interrupted multiple time-series design (Glass, Wilson, & Gottman, 1975) employing a non-equivalent comparison group, was used to investigate the effect of the IASP process on district compliance problems in the assessment and placement procedures used in the classification of students for special education. Failure to implement federal and state regulatory procedures for IEP development were also evaluated. The types of errors examined were: overall errors, decisions errors, use of suspect measures, procedural errors, and the degree to which student's individual educaiton plans (IEP) complied with state and federal regulations. A Chow-test was the statistical procedure used to determine if there was a significant difference between regressions lines (number of errors and/or change in trend) during pre- and post-intervention assessment.

To assess potential compliance problems, two data collectors evaluated a total of 383 files of students who had been classified as learning disabled (LD) or intellectually handicapped (IH). Student files were selected from four elementary schools (experimental group) and three secondary schools (comparison group). Files were reviewed prior to and following district interventions, using three validated expert systems (Class.LD2, Class.IH, Mandate Consultant). Based on the IASP findings, the district developed staff interventions that ranged from large group inservices to one-on-one. IASP follow-up data indicated that the interventions were ineffective; at which point, the district totally revised their staff development procedures and implemented a "mentor team" to monitor the classification and placement procedures for all students referred for admission to special education. The mentor team used the three expert systems (Class.LD2, Class.IH, Mandata Consultant) to review all requisite data with the special education teacher. The district used IASP monitoring and the mentor team approach throughout the 1990-1991 school year.

The summative evaluation yielded the following findings:

Use of the IASP data-based management, the expert systems, and the district intervention (i.e., use of mentor teachers) resulted in a dramatic decrease in the reduction of compliance errors in student files in the areas of LD and IH classification, and IEP development from pre- to post-assessment for schools in the experimental group. Performance of the comparison group remained unchanged as measured during pre- and post-intervention. Further analyses showed that the reduction in errors for the experimental group was statistically and educationally significant. There were no educationally significant findings for the comparison group.

Further, anecdotal information suggests that administrators and staff were pleased with the information provided by the IASP process and felt that it was extremely helpful in designing effective intervention strategies, and in providing current and relevant data regarding specific staff development. It whould be noted that based on the success of the IASP process, the district intends to expand the program into its secondary schools for the upcoming school year.

These findings strongly suggest that the combination of expert systems technology and a special education administrative data base created a powerful support system for progressively improving the quality of decisions made by multidisciplinary teams. Such decisions can have life-long implications for students begin considered for special education.

Based on these results, the following conclusions can be drawn.

1. The technology of expert systems and a central administrative data base can be combined to create an effective decision support system that can provide continuous feedback to administrators regarding the needs and on-going development of their staff.
2. The IASP can provide special education administrators with current information regarding the quality of classification decisions and regulatory procedures pertaining to IEP development. To increase its flexibility and value, the IASP can offer a variety of data options to the administrator. By cross-referencing with individual staff, and special education classification units, the administrator can easily pinpoint strengths and weaknesses on a general or individual basis in their district.

3. Because IASP was designed to integrate data bases from a variety of expert systems, the IASP can be easily upgraded to include the most relevant and valid systems. If a new expert system is developed, the addition of a data base from that system would be far less expensive than the development of a sophisticated front-end data base program. This design flexibility enhances the cost-effectiveness of the technology.

Limitations

Although the results of the present project are promising, it is important to note limitations of the data. The first limitation concerns the use of a time-series analysis that assumes equal time intervals in the assessment process. Due to the nature of the data, equal intervals across time were not possible as the majority of special education students are classified at the beginning of the school-year, a small number at the end of the school year, and relatively few in between. In this study, the files analyzed by the IASP process were sorted by the student's evaluation time, and corresponding outputs were then plotted on the x-axis according to their chronological order. Therefore, the results of the trend analysis (e.g., change in progressive increasing or decreasing errors by time) should be interpreted with the time limitation in mind.

A second limitation involves the sample population. In this study, elementary schools were used as an experimental group and secondary schools as a comparison group. Elementary schools were not selected to serve in the control group due to potential problems with contamination discussed in the Procedure Section. Because elementary and secondary schools may vary across a number of variables (e.g. service pattern, varying instructors, etc.), results of the study may only generalize to elementary schools.

Implications

Based on the findings, there were several implications, First, the review of literature clearly documented the need for effective information management system for special education administrators. Evidence obtained in this project suggests that special education administrators can effectively use feedback in the form of district-wide staff performance data to formulate and implement effective staff development programs.

Second, results of this study suggest that the IASP and previously developed systems have the potential to support staff development in two ways. First, conclusions were available in a prescriptive manner to direct staff development (e.g., identify which staff required training in what content areas). Additionally, on-going information served to evaluate the impact of the staff development and training on current performance.

The expert systems can act as effective preservice and inservice training tools. These systems can be used in their existing form or adapted to provide training models of appropriate decision-making. For example, in this study, members of the mentor team assisted teachers with the assessment, classification, and placement process. Teachers were walked step-by-step through the process beginning with the referral and ending with development of appropriate goals and objectives for an IEP.

Finally, although the IASP was designed to identify areas of compliance according to federal and Utah State rules, this system could easily be adapted for use by other states. In addition, because the field-test was conducted in a school district with the highest percentage of minority students in the state, the lowest tax base, and one of the highest student-to-teacher ratios in the nation, it is expected that the combination of expert systems technology and the IASP process could have beneficial results for other states with similar population characteristics.

Recommendations

The results of this study lead to the following recommendations:

1. In the present study, the summative field-test was conducted in a site with one of the highest minority student populations in the state. Current expert systems need to be expanded to ask more detailed information regarding disclaimer issues such as culture. Class.LD2 currently addresses cultural issues in a cursory fashion. Questions pertaining to a student's cultural background cover such areas as bilingualism, proficiency of English, number of years living in the United States, and percent of minorities in the student's school. Additional information regarding performance on formal bilingual tests and whether cultural problems preclude special education classification need to be addressed in all expert systems relating to classification.
2. To further validate the effectiveness of the IASP process, a replication of this study is needed. Additional research using secondary schools, and additional expert systems (e.g., Class.BD, Class.PH, or Class.CD) in conjunction with the IASP should be conducted. One important dependent variable that should be included in a replication should be the number of students classified in special education. While the present study

examined the reduction of compliance errors as a result of the IASP process, it was not clear whether there was a corresponding reduction in the number of students classified in special education.

3. Finally, the development and validation of the IASP process should be considered a beginning. Future studies should explore the variety of potential applications for computerized information management systems for special education administrators.

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Appendix A

Samples of IASP Summary Report

SAMPLE CONSTRAINTS:

This sample is drawn from class.ih records. Intellectual handicap issues are the primary focus of the class.ih expert system.

All class.ih caches were included in this report.

Report on
Problems with Data

School: A

☐ An academic test was not age-appropriate 1

Student 1

☐ Missing hearing evaluation 1

Student 2

☐ Missing speech/language evaluation 1

Student 3

☐ The adaptive test was not age-appropriate 5

Student 4
Student 5
Student 6
Student 7
Student 8

☐ Widely differing IQ and adaptive scores have been reported 4

Student 9
Student 10
Student 11
Student 12

Total number of values 12

School B

☐ Missing hearing evaluation 2

Student 1
Student 2

☐ Missing vision evaluation 7

Student 3
Student 4
Student 5
Student 6
Student 7
Student 8
Student 9

- ☐ Old test data was used 1

  Student 8

- ☐ The adaptive test was not age-appropriate 1

  Student 9

- ☐ Widely differing IQ and adaptive scores have been reported 5

  Student 10
  Student 11
  Student 12
  Student 13
  Student 14

  Total number of Values 16

School: C

- ☐ An academic test was not age-appropriate 1

  Student 1

- ☐ Missing hearing evaluation 1

  Student 2

- ☐ Missing vision evalution 2

  Student 3
  Student 2

- ☐ Old test data was used 3

  Student 4
  Student 5
  Student 6

- ☐ Widely differing IQ and adaptive scores have been reported 2

  Student 3
  Student 7

  Total number of Values 9

School: D

- ☐ Missing hearing evaluation 2

  Student 1
  Student 2

- ☐ Missing vision evalution 2

  Student 1
  Student 2

  Total number of values 4

School: E

- ☐ An academic test was not age-appropriate 1

  Student 1
- ☐ Widely differing IQ and adaptive scores have been reported 1

  Student 1

  Total number of values 2

Report on
Procedural Problems

The data for this report is found in 7 student fiels from 4 schools. Value(s) are reported in a school by school format.

School: A

☐ There was more than 30-days between parental permission & assessment dates 1

Student 1

Total number of values 1

School: B

☐ There was more than 30-day between parental permission & assessment dates . 1

Student 1

Total number of values . . . . 1☐

School: C

☐ There was more than 30-day between parental permission & assessment dates . 4

Student 1
Student 2
Student 3
Student 4

Total number of values 4

School: D

☐ There was more than 30-day between parental permission & assessment dates . 1

Student 1

Total number of values . . . . 1☐

Report on
Non-IH Explanations for the Problem(s)

The data for this report is found in 5 student files from 1 school. Value(s) are reported for the entire described sample as a group.

School: A

☐ Behavioral problems might account for the classroom difficulty 1

Student 1

☐ Cultural problems might account for the classroom difficulty 3

Student 1
Student 2
Student 3

Total number of values 4

Sample Constraints:

This sample is drawn from class.ld records. Learning disability issues are the primary focus of the Class.LD Expert System.

Limiting factor: School name
Limiting Value(s): Students with a value of 'TOSmith' were included in the sample

Report on
Overall System Advice

Bahavioral problems 1
School: 'TOSmith'
Student 1
Intellectually handicapped 1
School: 'TOSmith'
Student 2
Learning disabled 8
School: 'TOSmith'
Student 3
Student 4
Student 5
Student 6
Student 7
Student 8
Student 9
Student 10
Vision problems 2
School: 'TOSmith'
Student 5
Student 10
Total Number of Values 12

SAMPLE CONSTRAINTS:
This sample is drawn from class.ld records. Learning disability issues are the primary focus of the class.ld expert system.

Limiting Factor: School Name.
Limiting Value(s): Students with a value of 'TOSmith' were included in the sample.

Report on
Problems with Data

School: 'TOSmith'
Name: Student 1
Missing hearing evalution of 100
Name: Student 2
The hearing test data was missing of 100
Name: Student 3
Hearing data was old of 100

Report on
Procedural problems

The data for this report is found in 2 student files from 1 school. Value(s) are reported in a student by student format.

School: 'TOSmith'
Name: Student 1
Two or more QUALITY prereferral interventions have NOT been tried of 23
Name: Student 2
Two or more QUALITY prereferral interventions have NOT been tried of 32

SAMPLE CONSTRAINTS:

This sample is drawn from class.ld records. Learning disability issues are the primary focus of the class.ld expert system.

Limiting Factor: School name.
Limiting Value(s): Students with a value of "TOSmith' were included in the sample.

Report on
Overall System Advice

The data for this report is found in 5 student files from 1 school. Value(s) are reported for the entire described sample as a group.

Learning disabled 5
Student 1
Student 2
Student 3
Student 4
Student 5

Visual problems 2
Student 2
Student 5

Total Number of Values 7

Report on
Non-LD Explanations for the Problem(s)

The data for this report is found in 1 student file from 1 school. Value(s) are reported in a student-by-student format.

School: 'TOSmith'
Name: Student 5
Vision problems might account for the classroom difficulty of 100

SAMPLE CONSTRAINTS:

This sample is drawn from mandata consultant records. IEP Compliance issues are the primary focus of the mandate consultant expert system.

Limiting Factor: The student's School's name.
Limiting Value(s): Students with a value of 'TOSmith' were included in the sample.

Report on
Problems Associated with School Activities
Prior to the IEP Meeting

The data for this report is found in 8 student files from 1 school. Value(s) are reported in a student-by-student format.

School: 'TOSmith'
Name: Student 1
The student's parents were not told who the IEP team participants would be of 100
Two or more quality interventions were NOT tried of 100

Name: Student 2
After evalution, it took more than 30 days to develop the IEP of 100
Fewer than 5 working days notice were given to parents prior to the IEP meeting of 100.
There were more than 30 days between permission to evaluate and the evaluation of 100.

Name: Student 3
Fewer than 5 working day notice were given to parents prior to the IEP meeting of 100.
There were more than 30 days between permission to evaluate and the evaluation of 100.

Name: Student 4
Fewer than 5 working days notice were given to parents prior to the IEP meeting of 100.

Name: Student 5
After evaluation, it took more than 30 days to develop the IEP of 100.
Fewer than 5 working days notice were given to parents prior to the IEP meeting of 100.
Two or more QUALITY interventions were NOT tried of 100.

Name: Student 6
Fewer than 5 working days notice were given to parents prior to the IEP meeting of 100.

Name: Student 7
After evaluation, it took more than 30 days to develop the IEP of 100.
Fewer than 5 working days notice were given to parents prior to the IEP meeting.

Name: Student 8
Fewer than 5 working days notice were given to parents prior to the IEP meeting of 100.
There were more than 30 days between permission to evaluate and the evaluation of 100.
Two or more quality interventions were NOT tried of 100.

Report on
Problems Associated with the IEP Meeting

The data for this report is found in 5 student files from 1 school. Value(s) are reported in a student-by-student format.

School: 'TOSmith'

Name: Student 1
No representative of the public agency attended the IEP meeting of 100.
No surrogate parent attended the meeting and one was clearly needed of 100.

Name: Student 2
The student should have attended the IEP meeting but he/she did not attend of 100.

Name: Student 3
No representative of the public agency attended the IEP meeting of 100.

Name: Student 4
The student should have attended the IEP meeting but he/she did not attend of 100.

Name: Student 5
The student should have attended the IEP meeting but he/she did not attend of 100.

Report on
Problems Associated with the Development
of the IEP Document

The data for this report is found in 6 student files from 1 shcool. Value(s) are reported in a student-by-student format.

School: 'TOSmith'

Name: Student 1
The percentage of time in regular education is not listed on the IEP of 100.

Name: Student 2
NOT all of the objectives had clearly stated outcomes of 100.
The percentage of time in regular education is not listed on the IEP of 100.

Name: Student 3
NOT all of the objectives had clearly stated outcomes of 100.
The percentage of time in regular education is not listed on the IEP of 100.

Name: Student 4
The percentage of time in regular education is not listed on the IEP of 100.

Name: Student 5
NOT all of the objectives had clearly stated outcomes of 100.
The percentage of time in regular education is not listed on the IEP of 100.

Name: Student 6
NOT all of the objectives had clearly stated outcomes of 100.
The percentage of time in regular education is not listed on the IEP of 100.

Appendix B

District Intervention

Ogden District Interventions

Positive/Corrective

School: Elementary School

Date	Target Area(s)	Intervention(s)			Who is respon-sible?	How long?	Results	Follow-up
		G/Ind	Type	Description				
	The special education/regular education process	Group	Inservice	Project staff and district special education director presented to the entire faculty on the referral process: The importance of appropriateness of referrals; pre-referral interventions, accuracy of information, completeness of form; the importance/dangers of classification		1 hr 15 min	Yet to be determined by future referrals. Group seemed very appreciative to receive the information to better understand the process.	Yet to be determined.

Intervention: Key Descriptors

1. Group number or individual
2. Type; memo, letter, one-on-one, inservice, etc.
3. In-depth description

Ogden District Interventions

Positive/Corrective

School:

Date	Target Area(s)	Intervention(s)			Who is respon-sible?	How long?	Results	Follow-up
		G/Ind	Type	Description				
4/30/90	Assessment	Indiv.	One-on-one	The appropriate use of adaptive behavior measures was explained to the resource teacher.	Psycho-logist	30 min	To be determined	A special education coordinator will monitor other referrals for IH classifi-cation.

Intervention: <u>Key Descriptors</u>
1. Group number or individual
2. Type; memo, letter, one-on-one, inservice, etc.
3. In-depth description

Ogden District Interventions

Positive/Corrective

School: District

Date	Target Area(s)	Intervention(s)			Who is responsible?	How long?	Results	Follow-up
		G/Ind	Type	Description				
4/30/90	Hearing test results	Indiv.	Memo	A memo was sent to all special educational personnel informing them of the procedure for accessing hearing test results through the computer system.	Audri Bingham (audiologist)	N/A	To be determined	Check of files to see if more accurate hearing test results are recorded.

Intervention: Key Descriptors
1. Group number or individual
2. Type; memo, letter, one-on-one, inservice, etc.
3. In-depth description

Ogden District Interventions

Positive/Corrective

School: District wide

Date	Target Area(s)	Intervention(s)			Who is respon-sible?	How long?	Results	Follow-up
		G/Ind	Type	Description				
3/1/90	IEP - See list below	Group	Inserv.	An in-depth description of compliance in all of the target areas was given.	IEP Task Force	3 hrs	Copies of IEPs are submitted for compliance review. Then returned with comments to the teachers - some one-on-one inservice also.	Mini audits by special education coordinators for continued compliance (spot checks).

Intervention: Key Descriptors

1. Group number or individual
2. Type; memo, letter, one-on-one, inservice, etc.
3. In-depth description

IEP

a: Missing required signatures
b. Annual review greater than 1 year
c. Participation in regular education not documented
d. Related services not documented
e. Present level of performance not documented
f. Goals not related to classification
g. Objectives not related to classification
h. Objectives not measurable/lacking criterion time schedule
i. Less than 2 objectives for each goal

Appendix C

Classification Tracking Form

CLASSIFICATION TRACKING RECORD

SCHOOL ____________	STUDENT ____________
CLASSROOM TEACHER ____________	DATE OF BIRTH ____________
INITIAL/3 YR. EVALUATION ____________	GRADE ____________

CONTACT PERSON:	DATE:
PRIOR NOTICE ________ PARENT RIGHTS ________ REFERRAL COMPLETED ________ PERMISSION TO EVALUATE ________ SUSPECTED HANDICAP ________	REFERRAL ISSUES PREREFERRAL INTERVENTIONS: 1. ____________ 2. ____________ VISION: DATE ____ RESULTS ____ HEARING: DATE ____ RESULTS ____

ADDITIONAL PERTINENT INFORMATION:

INTELLECTUAL FUNCTIONING (I.Q.)	ADAPTIVE/SOC. BEHAVIOR (Required for IH, BD)
TEST(S) USED: DATE(S) GIVEN: RESULTS:	MEASURE USED: DATE: RESULTS:

ACADEMIC FUNCTIONING (i.e. Language, Math, Reading)		
TEST(S) USED: DATE: RESULTS:	TEST(S) USED: DATE: RESULTS:	TEST(S) USED: DATE: RESULTS:

OBSERVATION(S) (1 Required for LD, 3 Required for initial BD, with peer comparison)

#1 DATE: LOCATION: BY WHOM:

#2 DATE: LOCATION: BY WHOM:

#3 DATE: LOCATION: BY WHOM:

CLASSROOM DISCIPLINE

1. POSTED RULES YES NO N/A
2. POSTED CONSEQUENCES FOR FOLLOWING RULES YES NO N/A
3. POSTED CONSEQUENCES FOR NOT FOLLOWING RULES YES NO N/A
4. EVIDENCE THAT RULES AND CONSEQUENCES ARE BEING USED YES NO N/A

COMMENTS:

PHYSICAL OR HEALTH YES NO ____________

EMOTIONAL DISTURBANCE YES NO ____________

COMMUNICATIVE YES NO ____________

ECONOMIC FACTORS YES NO ____________

ENVIRONMENTAL FACTORS YES NO ____________

CULTURAL FACTORS YES NO ____________

ENGLISH PROFICIENCY ____________
YEARS RESIDENCY ____________
ETHNICITY ____________
%ETHNIC ORIGIN ____________

RESULTS (Check each area for which advise was given) DATE OPINION GENERATED ________

✓	ADVISE	c.f.	SUMMARY
	LD		
	BD		
	IH		
	SL		
	DNQ		

Appendix D

Classification Consultation Report

CLASS.IH CONSULTATION REPORT

Consultation Date:	10/20/91
Student's Name:	John Doe
School:	Plymouth
Age:	8 years 1 month

APTITUDE INFORMATION:

Test:	Wechester Intelligence Scale for Children - Revised (WISC-R full scale)
Date:	9/13/91
Score Name:	Full Scale IQ score (standard scores mean = 100 sd - 15)
Score:	69
Z Score:	-2.06667

ADAPTIVE INFORMATION:

Test:	Vineland Adaptive Behavior Scales
Date:	10/25/91
Score Name:	Standard scores mean = 100 sd - 15
Score:	65
Z Score:	-2.33333

Basic Reading Skills:

Test:	Woodcock Johnson Psycho-Educational Battery: Part II
Date:	10-5-91
Score Name:	Achievement standard score for Reading Cluster (mean = 100 SD = 15)
Score:	62
Z Score:	-2.5333

ALTERNATIVE SPECIAL EDUCATION:

No alternative special education problems were reported or those reported were not found to be severe enough to be the cause of the student's learning problem.

NON-SPECIAL EDUCATION OPTIONS:

Slow learner
If the information that you have provided is correct, the student probably should not be classified as intellectually handicapped. Test data suggest that this is a borderline student who, while being technically eligible for special education probably could be best served in a good regular education program for children at risk. (CS = 34/100)

BAD OR MISSING DATA:

Missing hearing evaluation
Missing vision evaluation

FINAL IH PLACEMENT ADVICE:

If one assumes that the bad or missing data DID NOT substantially mislead the computer program, you can be certain that an IH classification is appropriate with a certainty of 99 percent.

CLASS.LD CONSULTATION REPORT

Consultation Date:	10/20/91
Student's Name:	Jane Smith
Grade:	2.4
Age:	7 years 1 month

APTITUDE INFORMATION:

Test:	Wechester Intelligence Scale for Children - Revised (WISC-R full scale)
Score Name:	Full Scale IQ score (standard scores mean = 100 sd - 15)
Score:	98

DISCREPANCY INFORMATION:

Academic Problem Area:	Basic reading skills
Test:	Woodcock-Johnson Psycho-Educational Battery: Part II
Score Name:	Achievement standard score for the reading cluster (mean = 100 sd = 15)
Score:	70

Based on this information there is a 98 percent likelihood that the discrepancy in basic reading skills is severe enough for an LD placement in Utah.

ALTERNATIVE SPECIAL EDUCATION:

No alternative special education problems were reported or those reported were not found to be severe enough to be the cause of the student's learning problem.

NON-SPECIAL EDUCATION OPTIONS:

No alternative education options were found.

PRECLUSIONS FOR LD PLACEMENT:

No preclusions for LD placement were found.

BAD OR MISSING DATA:

No bad or missing data indicated.

FINAL LD PLACEMENT ADVICE:

You can be 98 percent certain that an LD classification is appropriate.

Appendix E

Corresponding Graphs Related to Chow Statistics

Casewise Plot of Standardized Residual

```
*: Selected    M: Missing

         -3.0      0.0      3.0
  Case #  O:........:........:O   ERRNUM     *PRED     *RESID
       1  .         .  *      .        6    4.8413     1.1587
       2  .         .*        .        5    4.8130      .1870
       3  .       * .         .        4    4.7848     -.7848
       4  .         .*        .        5    4.7565      .2435
       5  .       * .         .        4    4.7282     -.7282
       6  .         .*        .        5    4.7000      .3000
       7  .         .     *   .        7    4.6717     2.3283
       8  .         .   *     .        6    4.6435     1.3565
       9  .       * .         .        4    4.6152     -.6152
      10  .         .*        .        5    4.5869      .4131
      11  .         .   *     .        6    4.5587     1.4413
      12  .         .*        .        5    4.5304      .4696
      13  .        *.         .        4    4.5021     -.5021
      14  .         .*        .        5    4.4739      .5261
      15  .         .*        .        5    4.4456      .5544
      16  .        *.         .        4    4.4174     -.4174
      17  .        *.         .        4    4.3891     -.3891
      18  .     *   .         .        3    4.3608    -1.3608
      19  .        *.         .        4    4.3326     -.3326
      20  .        *.         .        4    4.3043     -.3043
      21  *         .         .        0    4.2760    -4.2760
      22  .   *     .         .        2    4.2478    -2.2478
      23  .      *  .         .        3    4.2195    -1.2195
      24  .         . *       .        5    4.1912      .8088
      25  .      *  .         .        3    4.1630    -1.1630
      26  .         .    *    .        6    4.1347     1.8653
      27  .      *  .         .        3    4.1065    -1.1065
      28  .         .    *    .        6    4.0782     1.9218
      29  .      *  .         .        3    4.0499    -1.0499
      30  .         .  *      .        5    4.0217      .9783
      31  .      *  .         .        3    3.9934     -.9934
      32  .         *         .        4    3.9651      .0349
      33  .      *  .         .        3    3.9369     -.9369
      34  .         *         .        4    3.9086      .0914
      35  .       * .         .        3    3.8804     -.8804
      36  .         .     *   .        6    3.8521     2.1479
      37  .       * .         .        3    3.8238     -.8238
      38  .         .  *      .        5    3.7956     1.2044
      39  .       * .         .        3    3.7673     -.7673
      40  .         .     *   .        6    3.7390     2.2610
  Case #  O:........:........:O   ERRNUM     *PRED     *RESID
         -3.0      0.0      3.0
```

Equation Number 1   Dependent Variable.   ERRNUM

Casewise Plot of Standardized Residual

*: Selected   M: Missing

```
          -3.0      0.0      3.0
 Case #   O:........:........:O   ERRNUM      *PRED      *RESID
      1   .         . *       .        6     5.2434       .7566
      2   .         . *       .        6     5.2104       .7896
      3   .    *    .         .        3     5.1775     -2.1775
      4   .         .   *     .        7     5.1145      1.8555
      5   .         . *       .        6     5.1115       .8885
      6   .       * .         .        4     5.0786     -1.0786
      7   .       * .         .        4     5.0456     -1.0456
      8   .         . *       .        6     5.0126       .9874
      9   .         .    *    .        7     4.9796      2.0204
     10   .       * .         .        4     4.9467      -.9467
     11   .         *         .        5     4.9137       .0863
     12   .         .  *      .        6     4.8807      1.1193
     13   .         *         .        5     4.8478       .1522
     14   .         *         .        5     4.8148       .1852
     15   .       * .         .        4     4.7818      -.7818
     16   .     *   .         .        3     4.7489     -1.7489
     17   .   *     .         .        2     4.7159     -2.7159
     18   .         .  *      .        6     4.6829      1.3171
     19   .   *     .         .        2     4.6500     -2.6500
     20   .   *     .         .        2     4.6170     -2.6170
     21   .         .  *      .        6     4.5840      1.4160
     22   .         .*        .        5     4.5511       .4489
     23   .        *.         .        4     4.5181      -.5181
     24   .         .     *   .        7     4.4851      2.5149
     25   .         .*        .        5     4.4522       .5478
     26   .        *.         .        4     4.4192      -.4192
     27   .         .   *     .        6     4.3862      1.6138
     28   .      *  .         .        1     2.0879     -1.0879
     29   .         . *       .        3     1.9560      1.0440
     30   .         *         .        2     1.8571       .1429
     31   .         *         .        2     1.8242       .1758
     32   .         .*        .        2     1.7582       .2418
     33   .         *         .        2     2.0549      -.0549
     34   .       * .         .        1     2.0220     -1.0220
     35   .         *         .        2     1.9890       .0110
     36   .         . *       .        3     2.1209       .8791
     37   .         *         .        2     1.9231       .0769
     38   .         *         .        2     1.8901       .1099
     39   .         *         .        2     1.7912       .2088
     40   .       * .         .        1     1.7253      -.7253
 Case #   O:........:........:O   ERRNUM      *PRED      *RESID
          -3.0      0.0      3.0
```

Equation Number 1   Dependent Variable..   ERRNUM

Casewise Plot of Standardized Residual

*: Selected   M: Missing

```
           -3.0       0.0       3.0
  Case #   O:........:........:O     ERRNUM      *PRED      *RESID
     1     .         .   *     .          8     5.1938      2.8062
     2     .      *  .         .          3     5.1800     -2.1800
     3     .         *         .          5     5.1661      -.1661
     4     .         .*        .          6     5.1523       .8477
     5     .       * .         .          4     5.1385     -1.1385
     6     .        *.         .          4     5.1246     -1.1246
     7     .         .  *      .          7     5.1108      1.8892
     8     .        *.         .          4     5.0970     -1.0970
     9     .        *.         .          4     5.0831     -1.0831
    10     .         .  *      .          7     5.0693      1.9307
    11     .  *      .         .          0     5.0555     -5.0555
    12     .        *.         .          4     5.0416     -1.0416
    13     .         .  *      .          7     5.0278      1.9722
    14     .         .*        .          6     5.0139       .9861
    15     .  *      .         .          0     5.0001     -5.0001
    16     .         .  *      .          7     4.9863      2.0137
    17     .         .   *     .          8     4.9724      3.0276
    18     .         .   *     .          8     4.9586      3.0414
    19     .        *.         .          4     4.9448      -.9448
    20     .      *  .         .          3     4.9309     -1.9309
    21     .         *         .          5     4.9171       .0829
    22     .         .*        .          6     4.9032      1.0968
    23     .         .*        .          6     4.8894      1.1106
    24     .   *     .         .          0     4.8756     -4.8756
    25     .         .  *      .          7     4.8617      2.1383
    26     .       * .         .          3     4.8479     -1.8479
    27     .         .  *      .          7     4.8341      2.1659
    28     .       * .         .          3     4.8202     -1.8202
    29     .       * .         .          3     4.8064     -1.8064
    30     .         *         .          5     4.7925       .2075
    31     .         .   *     .          8     4.7787      3.2213
    32     .   *     .         .          0     4.7649     -4.7649
    33     .         . *       .          6     4.7510      1.2490
    34     .        *.         .          4     4.7372      -.7372
    35     .         . *       .          6     4.7234      1.2766
    36     .         .         *         13     4.7095      8.2905
    37     .         .     *   .          9     4.6957      4.3043
    38     .         . *       .          6     4.6819      1.3181
    39     .         *         .          5     4.6680       .3320
    40     .   *     .         .          0     4.6542     -4.6542
  Case #   O:........:........:O     ERRNUM      *PRED      *RESID
           -3.0       0.0       3.0
```

Casewise Plot of Standardized Residual

*: Selected   M: Missing

```
        -3.0       0.0       3.0
Case #    O:........:........:O    ERRNUM      *PRED     *RESID
  41      .       * .         .       3       3.7108     -.7108
  42      .         .   *     .       5       3.6825     1.3175
  43      .         .*        .       2       1.7506      .2494
  44      .         .*        .       2       1.7223      .2777
  45      .       * .         .       1       1.6941     -.6941
  46      .         .*        .       2       1.6658      .3342
  47      .       * .         .       1       1.6375     -.6375
  48      .     *   .         .       0       1.6093    -1.6093
  49      .         .*        .       2       1.5810      .4190
  50      .        *.         .       1       1.5527     -.5527
  51      .         .*        .       2       1.5245      .4755
  52      .         .*        .       2       1.4962      .5038
  53      .         .*        .       2       1.4679      .5321
  54      .         . *       .       2       1.4397      .5603
  55      .         . *       .       2       1.4114      .5886
  56      .         . *       .       2       1.3832      .6168
  57      .         . *       .       2       1.3549      .6451
  58      .         . *       .       2       1.3266      .6734
  59      .     *   .         .       0       1.2984    -1.2984
  60      .        *.         .       1       1.2701     -.2701
  61      .         . *       .       2       1.2418      .7582
  62      .        *.         .       1       1.2136     -.2136
  63      .      *  .         .       0       1.1853    -1.1853
  64      .      *  .         .       0       1.1571    -1.1571
  65      .         . *       .       2       1.1288      .8712
  66      .      *  .         .       0       1.1005    -1.1005
  67      .         *         .       1       1.0723     -.0723
  68      .      *  .         .       0       1.0440    -1.0440
  69      .         *         .       1       1.0157     -.0157
  70      .         .  *      .       2        .9875     1.0125
  71      .         *         .       1        .9592      .0408
  72      .         .  *      .       2        .9309     1.0691
  73      .         *         .       1        .9027      .0973
  74      .         *         .       1        .8744      .1256
Case #    O:........:........:O    ERRNUM      *PRED     *RESID
        -3.0       0.0       3.0
```

Residuals Statistics:

	Min	Max	Mean	Std Dev	N
*PRED	1.7253	5.2434	3.8750	1.3900	40
*RESID	-2.7159	2.5149	-.0000	1.2712	40
*ZPRED	-1.5465	.9844	.0000	1.0000	40
*ZRESID	-2.0810	1.9270	-.0000	.9740	40

Total Cases = 40

* *

Histogram - Standardized Residual

```
NExp N        (* = 1 Cases,     . : = Normal Curve)
0   .03   Out
0   .06  3.00
0   .16  2.67
0   .36  2.33
1   .73  2.00 :
1 1.34   1.67 :
2 2.19   1.33 *:
3 3.23   1.00 **:
6 4.25    .67 ***:**
3 5.01    .33 *** .
* 5.29    .00 ****:*****
2 5.01   -.33 **  .
6 4.25   -.67 ***:**
1 3.23  -1.00 * .
1 2.19  -1.33 *.
1 1.34  -1.67 :
3   .73 -2.00 :**
0   .36 -2.33
0   .16 -2.67
0   .06 -3.00
0   .03   Out
```

Casewise Plot of Standardized Residual

*: Selected   M: Missing

```
          -3.0       0.0        3.0
 Case #   O:........:........:O    ERRNUM      *PRED      *RESID
   41     .       * .         .         3     4.6403     -1.6403
   42     .       * .         .         3     4.6265     -1.6265
   43     .       * .         .         3     4.6127     -1.6127
   44     .      *  .         .         2     4.5988     -2.5988
   45     .        *.         .         4     4.5850      -.5850
   46     .         .  *      .         7     4.5712      2.4288
   47     .         .     *   .         9     4.5573      4.4427
   48     .         .     *   .         9     4.5435      4.4565
   49     .      *  .         .         2     4.5296     -2.5296
   50     .         . *       .         6     4.5158      1.4842
   51     .         .    *    .         8     4.5020      3.4980
   52     .       * .         .         3     4.4881     -1.4881
   53     .         .*        .         5     4.4743       .5257
   54     .        *.         .         4     4.4605      -.4605
   55     .        *.         .         4     4.4466      -.4466
   56     .         . *       .         6     4.4328      1.5672
   57     .   *     .         .         0     4.4190     -4.4190
   58     .   *     .         .         0     4.4051     -4.4051
   59     .        *.         .         4     4.3913      -.3913
   60     .      *  .         .         2     4.3774     -2.3774
   61     .         .   *     .         7     4.3636      2.6364
   62     .      *  .         .         2     4.3498     -2.3498
   63     .      *  .         .         2     4.3359     -2.3359
   64     .         .*        .         5     4.3221       .6779
   65     .      *  .         .         2     4.3083     -2.3083
   66     .         .     *   .         9     4.2944      4.7056
   67     .         .   *     .         7     4.2806      2.7194
   68     .      *  .         .         2     4.2667     -2.2667
   69     .         .   *     .         7     4.2529      2.7471
   70     .      *  .         .         2     4.2391     -2.2391
   71     .         *         .         4     4.2252      -.2252
   72     .       * .         .         3     4.2114     -1.2114
   73     .       * .         .         3     4.1976     -1.1976
   74     .         *         .         4     4.1837      -.1837
   75     .         .   *     .         7     4.1699      2.8301
   76     .         *         .         4     4.1560      -.1560
   77     .         . *       .         6     4.1422      1.8578
   78     .         *         .         4     4.1284      -.1284
   79     .         .  *      .         6     4.1145      1.8855
   80     .         .  *      .         6     4.1007      1.8993
   81     .     *   .         .         1     4.0869     -3.0869
   82     .         .*        .         5     4.0730       .9270
   83     .     *   .         .         1     4.0592     -3.0592
   84     .         *         .         0      .3654      -.3654
 Case #   O:........:........:O    ERRNUM      *PRED      *RESID
          -3.0       0.0        3.0
```

Residuals Statistics:

	Min	Max	Mean	Std Dev	N
*PRED	.8744	4.8413	2.9865	1.5039	74
*RESID	-4.2760	2.3283	.0000	1.0972	74
*ZPRED	-1.4044	1.2334	-.0000	1.0000	74
*ZRESID	-3.8434	2.0927	.0000	.9862	74

Total Cases = 74

* *

Histogram - Standardized Residual

```
NExp N      (* = 1 Cases,     . : = Normal Curve)
0   .06   Out
0   .11  3.00
0   .29  2.67
0   .66  2.33 .
3 1.35   2.00 :**
2 2.47   1.67 *:
3 4.06   1.33 ***.
5 5.97   1.00 *****.
8 7.86    .67 *******:
* 9.27    .33 ********:*****
7 9.80    .00 *.*****   .
8 9.27   -.33 ********.
9 7.86   -.67 *******:*
* 5.97  -1.00 *****:****
3 4.06  -1.33 ***.
0 2.47  -1.67  .
1 1.35  -2.00 :
0   .66 -2.33 .
0   .29 -2.67
0   .11 -3.00
1   .06   Out *
```

```
Standardized Scatterplot
Across - *PRED          Down - *RESID
Out EEDDDDDEDDDDDEDDDDDEDDDDDEDDDDDEDDDDDEE
  3 E                                     E   Symbols:
    3                                     3
    3                                     3      Max N
  2 E                     .               E
    3                       .             3   .     1.0
    3                    .  .             3   :     2.0
  1 E                     :.              E   *     4.0
    3          :            ::            3
    3         .          ..               3
  0 E         **            *             E
    3                    ..               3
    3         ..            .*            3
 D1 E          .                          E
    3                       .             3
    3                         .           3
 D2 E                     :.              E
    3                                     3
    3                                     3
 D3 E                                     E
Out EEDDDDDEDDDDDEDDDDDEDDDDDEDDDDDEDDDDDEE
     D3    D2    D1     0     1     2     3 Out
```

```
Standardized Scatterplot
Across - TIMEIH        Down - *RESID
Out EEDDDDDEDDDDDEDDDDDEDDDDDEDDDDDEDDDDDEE
  3 E                                     E   Symbols:
    3                                     3
    3                                     3      Max N
  2 E                     .               E
    3             .                       3   .     1.0
    3           .          .              3   :     2.0
  1 E               .  ..                 E
    3         ... .         . .           3
    3                    ..      .        3
  0 E              ...       ..::.        E
    3                    . .              3
    3            : . .       .    .       3
 D1 E                          .          E
    3                  .                  3
    3          .                          3
 D2 E                  ...                E
    3                                     3
    3                                     3
 D3 E                                     E
Out EEDDDDDEDDDDDEDDDDDEDDDDDEDDDDDEDDDDDEE
     D3    D2    D1     0     1     2     3 Out
```

Casewise Plot of Standardized Residual

*: Selected   M: Missing

```
          -3.0      0.0      3.0
  Case #  O:........:........:O   ERRNUM        *PRED        *RESID
     85   .         .*        .        1        .3515         .6485
     86   .         *         .        0        .3377        -.3377
     87   .         *         .        0        .3239        -.3239
     88   .         .*        .        1        .3100         .6900
     89   .         *         .        0        .2962        -.2962
     90   .         *         .        0        .2823        -.2823
     91   .         *         .        0        .2685        -.2685
     92   .         *         .        0        .2547        -.2547
     93   .         *         .        0        .2408        -.2408
     94   .         *         .        0        .2270        -.2270
     95   .         .*        .        1        .2132         .7868
     96   .         *         .        0        .1993        -.1993
     97   .         .*        .        1        .1855         .8145
     98   .         *         .        0        .1717        -.1717
     99   .         *         .        0        .1578        -.1578
    100   .         *         .        0        .1440        -.1440
    101   .         *         .        0        .1301        -.1301
    102   .         *         .        0        .1163        -.1163
    103   .         *         .        0        .1025        -.1025
    104   .         .*        .        1        .0886         .9114
    105   .         *         .        0        .0748        -.0748
    106   .         *         .        0        .0610        -.0610
    107   .         *         .        0        .0471        -.0471
    108   .         *         .        0        .0333        -.0333
    109   .         *         .        0        .0194        -.0194
    110   .         *         .        0  5.60957E-03   -5.6096E-03
    111   .         *         .        0  -8.2274E-03   8.22737E-03
  Case #  O:........:........:O   ERRNUM        *PRED        *RESID
          -3.0      0.0      3.0
```

* * * *   M U L T I P L E   R E G R E S S I O N   * * * *

Equation Number 1   Dependent Variable..   ERRNUM

Residuals Statistics:

	Min	Max	Mean	Std Dev	N
*PRED	-.0082	5.1938	3.5045	1.9626	111
*RESID	-5.0555	8.2905	-.0000	2.2362	111
*ZPRED	-1.7899	.8608	.0000	1.0000	111
*ZRESID	-2.2401	3.6736	-.0000	.9909	111

Total Cases =   111

```
Standardized Scatterplot
Across - *PRED        Down - *RESID
Out EEDDDDDDEDDDDDDEDDDDDDEDDDDDDEDDDDDDEDDDDDDEE
  3 E                                           E   Symbols:
    3                                           3
    3                                           3     Max N
  2 E                        :    .             E
    3                         ..                3   .       1.0
    3                        .   ..             3   :       2.0
  1 E            :           ..   .             E   *       5.0
    3             **            .               3
    3              **            **             3
  0 E            *            :                 E
    3             :.           :*               3
    3               :        *.  .:             3
 D1 E            ::           *:                E
    3             . .           .               3
    3                                           3
 D2 E                          .                E
    3                                           3
    3                                           3
 D3 E                                           E
Out EEDDDDDDEDDDDDDEDDDDDDEDDD . DDDDDEDDDDDDEE
    D3     D2     D1      0      1      2      3 Out
```

```
Standardized Scatterplot
Across - TIMEMC       Down - *RESID
Out EEDDDDDDEDDDDDDEDDDDDDEDDDDDDEDDDDDDEDDDDDDEE
  3 E                                           E   Symbols:
    3                                           3
    3                                           3     Max N
  2 E          .          ..                    E
    3                 :                         3   .       1.0
    3           ..        .                     3   :       2.0
  1 E         .         . .         ..          E   *       4.0
    3                .          *...            3
    3         .:.:.         *.*                 3
  0 E                   ..         .::          E
    3             .::        .   ..             3
    3         ...        .:...                  3
 D1 E                .::.         :..           E
    3               .        .   .              3
    3                                           3
 D2 E                .                          E
    3                                           3
    3                                           3
 D3 E                                           E
Out EEDDDDDDEDDDDD . DDDEDDDDDDEDDDDDDEDDDDDDEE
    D3     D2     D1      0      1      2      3 Out
```

* * * * * * * * * * * * * * * * * *

Histogram - Standardized Residual

```
NExp N      (* = 1 Cases,    . : = Normal Curve)
1   .09   Out *
0   .17  3.00
0   .43  2.67
0   .99  2.33 .
4 2.03   2.00 *:**
1 3.71   1.67 *  .
8 6.09   1.33 *****:**
9 8.95   1.00 ********:
6 11.8    .67 ******      .
* 13.9    .33 ************ .
* 14.7    .00 **************:****************
* 13.9   -.33 **********     .
* 11.8   -.67 ********** .
* 8.95  -1.00 *********:*
2 6.09  -1.33 **    .
0 3.71  -1.67     .
5 2.03  -2.00 *:***
2   .99 -2.33 :*
0   .43 -2.67
0   .17 -3.00
0   .09   Out
```

```
Standardized Scatterplot
Across - *PRED        Down - *RESID
Out EEDDDDDEDDDDDDEDDDDDDEDD . EDDDDDEDDDDDEE
  3 E                                       E   Symbols:
    3                                       3
    3                                       3      Max N
  2 E                    ...                E
    3                     .                 3   .      4.0
    3                    ....               3   :      8.0
  1 E                    ....               E   *     17.0
    3                    ...                3
    3         :          ....               3
  0 E        :*          . ..               E
    3                     ...               3
    3                    ....               3
 D1 E                    .:..               E
    3                    .                  3
    3                                       3
 D2 E                     ..                E
    3                       .               3
    3                                       3
 D3 E                                       E
Out EEDDDDDEDDDDDD    DDEDDDDDEDDDDDDEDDDDDDEE
    D3     D2     D1     0     1     2     3 Out
```

```
Standardized Scatterplot
Across - TIMELD       Down - *RESID
Out EEDDDDDEDDDDDE . DDEDDDDDEDDDDDDEDDDDDDEE
  3 E                                       E   Symbols:
    3                                       3
    3                                       3      Max N
  2 E              . ..  .                  E
    3                .                      3   .      1.0
    3       . : .    .: .                   3   :      2.0
  1 E        :.... .    :                   E   *      5.0
    3          :. ..    .                   3
    3       . . :   . .  :....              3
  0 E       .  .  . .   ::.*****            E
    3        *..  . . :.                    3
    3       .  .: :..   :                   3
 D1 E       .  .    .. *:.                  E
    3                    :                  3
    3                                       3
 D2 E          . ..  :                      E
    3         :                             3
    3                                       3
 D3 E                                       E
Out EEDDDDDEDDDDDDEDDDDDDEDDDDDDEDDDDDDEDDDDDDEE
    D3     D2     D1     0     1     2     3 Out
```

Appendix F

Raw Data

Pre- and Post- Intervention Data for Experimental Group with Learning Disabled

Pre Post	school	errnum	ld1err	ld2err	ld3err
0	4	8	1	4	3
0	4	3	0	2	1
0	2	5	0	3	2
0	4	6	1	3	2
0	3	4	1	1	2
0	4	4	0	3	1
0	3	7	1	4	2
0	3	4	0	3	1
0	3	4	0	2	2
0	3	7	1	3	3
0	2	0	0	0	0
0	3	4	0	2	2
0	3	7	1	4	2
0	3	6	0	4	2
0	2	0	0	0	0
0	4	7	1	4	2
0	3	8	2	4	2
0	4	8	1	3	4
0	2	4	1	2	1
0	1	3	1	2	0
0	3	5	1	3	1
0	3	6	1	3	2
0	3	6	1	3	2
0	1	0	0	0	0
0	4	7	2	3	2
0	1	3	0	2	1
0	4	7	1	4	2
0	1	3	0	2	1
0	4	3	0	2	1
0	2	5	1	3	1
0	3	8	2	4	2
0	3	0	0	0	0
0	1	6	2	3	1
0	1	4	1	2	1
0	1	6	2	2	2
0	1	13	3	7	3
0	2	9	1	5	3
0	1	6	1	3	2
0	4	5	1	3	1
0	1	0	0	0	0
0	2	3	0	2	1
0	3	3	0	1	2

0	1	3	0	2	1
0	1	2	0	1	1
0	1	4	0	3	1
0	1	7	1	4	2
0	2	9	2	5	2
0	2	9	2	6	1
0	2	2	0	1	1
0	3	6	0	4	2
0	1	8	2	3	2
0	3	3	0	2	1
0	1	5	0	3	2
0	1	4	0	3	1
0	1	4	0	2	2
0	1	6	0	4	2
0	3	0	0	0	0
0	3	0	0	0	0
0	3	4	1	2	1
0	4	2	0	1	1
0	2	7	1	4	2
0	1	2	0	2	0
0	4	2	0	2	0
0	1	5	0	4	1
0	1	2	0	1	1
0	4	9	2	4	3
0	1	7	2	3	2
0	1	2	0	2	0
0	1	7	2	3	2
0	1	2	0	1	1
0	4	4	1	1	2
0	1	3	1	1	1
0	1	3	0	2	1
0	2	4	0	2	2
0	3	7	1	3	3
0	3	4	1	2	1
0	2	6	1	2	3
0	4	4	1	2	1
0	2	6	1	2	3
0	3	6	2	2	2
0	2	1	0	1	0
0	3	5	1	3	1
0	1	1	0	0	1
1	2	0	0	0	0
1	3	1	0	0	1
1	2	0	0	0	0
1	1	0	0	0	0
1	2	1	1	0	0
1	1	0	0	0	0
1	2	0	0	0	0
1	2	0	0	0	0
1	1	0	0	0	0
1	2	0	0	0	0
1	2	0	0	0	0
1	1	1	0	1	0
1	1	0	0	0	0

1	2	1	1	0	0
1	4	0	0	0	0
1	1	0	0	0	0
1	1	0	0	0	0
1	3	0	0	0	0
1	3	0	0	0	0
1	3	0	0	0	0
1	3	1	1	0	0
1	1	0	0	0	0
1	3	0	0	0	0
1	3	0	0	0	0
1	1	0	0	0	0
1	1	0	0	0	0
1	4	0	0	0	0
1	4	0	0	0	0

Pre- and Post- Intervention Data for Experimental Group with IEP Development

Pre Post	school	errnum	mc1err	mc2err	mc3err
0	1	6	3	2	1
0	4	5	3	1	1
0	4	4	2	1	1
0	4	5	2	3	0
0	1	4	2	1	1
0	4	5	2	1	2
0	4	7	3	2	2
0	4	6	3	1	2
0	4	4	1	2	1
0	1	5	3	1	1
0	1	6	3	2	1
0	3	5	3	1	1
0	3	4	2	1	1
0	3	5	3	1	1
0	3	5	3	1	1
0	4	4	2	1	1
0	1	4	2	2	0
0	1	3	2	1	0
0	1	4	2	2	0
0	1	4	2	1	1
0	1	0	4	2	1
0	1	2	1	1	0
0	1	3	1	1	1
0	3	5	2	2	1
0	2	3	1	1	1
0	4	6	4	1	1
0	2	3	1	1	1
0	3	6	2	3	1
0	3	3	1	1	1
0	2	5	2	2	1
0	3	3	2	1	0
0	2	4	2	1	1
0	2	3	1	1	1
0	3	4	2	1	1
0	2	3	1	1	1
0	2	6	3	1	2
0	2	3	1	1	1
0	2	5	2	2	1
0	2	3	1	1	1
0	2	6	3	1	2
0	2	3	2	1	0
0	1	5	2	2	1

1	3	2	1	1	0
1	3	2	1	1	0
1	4	1	0	0	1
1	1	2	0	1	1
1	3	1	0	1	0
1	4	0	0	0	0
1	4	2	1	1	0
1	3	1	0	1	0
1	1	2	1	1	0
1	1	2	1	0	1
1	2	2	1	1	0
1	2	2	1	1	0
1	2	2	1	1	0
1	1	2	1	0	1
1	2	2	1	1	0
1	1	2	1	1	0
1	4	0	0	0	0
1	3	1	0	1	0
1	1	2	1	1	0
1	4	1	1	0	0
1	4	0	0	0	0
1	4	0	0	0	0
1	1	2	1	1	0
1	4	0	0	0	0
1	1	1	0	0	0
1	4	0	0	0	0
1	4	1	0	0	0
1	2	2	1	1	0
1	3	1	0	1	0
1	1	2	1	1	0
1	1	1	0	1	0
1	3	1	0	1	0

Pre- and Post- Intervention Data for Experimental Group with Intellectually Disabled

Pre Post	school	errnum	ih1err	ih2err
0	2	6	2	4
0	2	6	1	5
0	2	3	0	3
0	2	7	3	4
0	2	6	3	3
0	2	4	0	4
0	2	4	0	4
0	2	6	2	4
0	2	7	2	5
0	2	4	2	2
0	1	5	1	4
0	2	6	2	4
0	2	5	2	3
0	2	5	3	2
0	2	4	2	2
0	2	3	0	3
0	2	2	0	2
0	1	6	2	4
0	2	2	0	2
0	2	2	0	2
0	2	6	2	4
0	2	5	1	4
0	3	4	0	4
0	3	7	2	5
0	2	5	1	4
0	2	4	2	2
0	3	6	3	3
1	2	1	0	1
1	2	3	1	2
1	3	2	1	1
1	3	2	1	1
1	2	2	1	1
1	1	2	1	1
1	3	1	0	1
1	2	2	0	2
1	3	3	0	2
1	2	2	1	1
1	3	2	0	2
1	1	2	1	1
1	2	1	0	1