
Mathematics Standards and Educational Therapy

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INTRODUCTION TO THE PROBLEM

There is a lack of consensus among educational therapists about the appropriate response to mathematics difficulties. Informal conversations with educational therapists indicate some clinicians do not believe that mathematics intervention is appropriate in a profession that has traditionally focused on language needs. According to some of the educational therapists interviewed, when faced with a client who is experiencing difficulty learning mathematics, it is not unusual for them to refer the client to professionals who are identified as mathematics specialists. Another response may be to choose intervention strategies and methodological approaches that are not necessarily aligned with the client's immediate mathematics needs; specifically the need to meet the mathematics standards required of students in public school classrooms. Educational therapists are not required to have professional training in mathematics computation, mathematics instructional methodology, or the use of standards. This article focuses on the influence that the awareness of mathematics standards has on educational therapists' responses to mathematics difficulties in the one-to-one setting.

The influence that national, state, and local mathematics standards have on the ability of the educational therapist to diagnose, evaluate, and develop effective mathematics interventions is subtle but of considerable importance. Educational therapists may not be aware of the prevailing beliefs and priorities related to mathematics instruction. A valuable example of the impact that mathematics standards have on the learning process in public school classrooms is demonstrated by the events that followed the California Board of Education's embrace of the National Council of Teachers of Mathematics (NCTM) progressivist reform movement in the early in 1980s. This decision set in motion waves of state and local school district standard documents that often contained conflicting mathematics goals. The confusion that followed as a result of the frequently changing ideological objectives of mathematics standards has had an effect on academic achievement in the classroom and has especially impacted learning disabled students (Klein, 2003; Holtzman et al., 2000; Dixon, Carnine, Lee, & Wallen, 1998; Carnine, 1997). While California's response to the national progressivist reform movement goals advanced by the NCTM may be extreme in comparison to that of other states, the far-reaching results of California's decisions highlight many of the possible

responses within the polarized mathematics community across the nation.

SUMMARY OF LITERATURE REVIEW

Mathematics Standards: Four Literature Themes Relevant to the Classroom

There is little direct research into the affects that mathematics standards have on the practice of Educational Therapy. Recent literature does, however, identify four areas related to national, state, and local mathematics standards that have influenced the overall ability of classroom teachers to effectively deliver consistent mathematics instruction in California:¹ First, as mentioned above, the mathematics reform movement, which resulted in a history of fluctuating national standards (Klein, 2003). Second, the example of California's "Math Wars"—a term attributed to U.S. Education Secretary Richard Riley, Professor at California State University Northridge, that describes the polarization of the mathematics community in California, the public's response to low test scores, and the Board of Education's response to these influences with decisions that produced a series of dissimilar state mathematics standards (Klein, 2003; Jacobs, 2001). Third, the incomplete alignment of individual school districts in California to the State's various sets of mathematics standards (Holtzman et al., 2000, chapter 5; Klein, 2003, pp. 28, 34). Although the State of California requires that instructional materials be aligned with standards, many school districts had invested resources into the constructivist-inspired 1996–97 mathematics content standards and resisted alignment to the 1998 revised version, which was rewritten and approved without much input from teachers to include traditional basic math skills and computation (Holtzman, 2000, chapter 4). And fourth, the conflicting reactions of experts from different areas of mathematics education to the impact of mathematics standards on both mainstream and learning disabled student populations. The differences of opinion between those who support the NCTM constructivist ideology and those who agreed with the university researchers, recommendation of traditional mathematics education was further compounded by the opinions of educational researchers who specialize in learning disabilities. All of the latter experts support the traditionalists' direct instructional approaches to mathematics instruction, but many also suggest various "hybrid" approaches to the problem of learning differences in the classroom. These hybrid approaches hope to meet the needs of the learning disabled student in the classroom by combining the traditional explicit direct instruction methods with the progressivist constructivist pedagogic theories of instruction (Goldman & Hasselbring, 1997). These four areas were also studied for their relevance to the one-to-one setting.

¹The application of these areas to public schools across the nation largely depends on the response of each state to the mathematics reform movement over the past 100 years.

Five Reoccurring Influences Identified in the Literature Themes

An analysis of the four areas of literature identified above revealed the following five major reoccurring influences of standards on the educational process in mathematics classrooms:

DISAGREEMENT ABOUT THE GOALS OF MATHEMATICS INSTRUCTION

The ongoing historical disagreement between progressivists and traditional reformers has spanned the last one hundred years. Classroom teachers and the constructivist educational ideologies have clashed with university mathematicians who emphasize traditional mathematics instruction.

IDEOLOGICAL AND PEDAGOGIC PREFERENCE

The influence of William Heard Kilpatrick, who taught progressivist ideas to more than 35,000 teaching candidates during his 27-year career at Teachers College at Columbia University, advanced the acceptance of the progressivist ideology as the standard curriculum for teacher preparation. Kilpatrick's influence as an education professor began in 1911 and was distinguished in 1925 with the widespread acceptance of his progressivist inspired work, *Foundations of Method*, as the standard text for teacher education courses across the country. Kilpatrick's influence on teacher education courses still has weight today in forming ideological and pedagogic preferences (Klein, 2003).

Research of the California Math Wars revealed that one salient factor in the dynamics involved in the controversy was individual districts' ideologies and preferences, which often leaned strongly toward the constructivist curriculum to which they had committed resources before the 1997 mathematics standards were rewritten under political pressure. This is not surprising because many classroom teachers were trained to teach using constructivist pedagogic practices.

CONFUSION ABOUT THE MEANING OF THE TERM "STANDARDS" AND WHICH STANDARDS ARE AUTHORIZED

Although the NCTM standards (1989, 1991, 2000) are popular with many districts and with classroom teachers, current literature describes them as being as vague as they are revolutionary. California's current endorsement of mathematics standards and framework that lean heavily toward traditional goals has lacked influence in constructivist classrooms. Add to this the local district benchmarks and individual school policies and it becomes clear why many teachers were not sure which standards if any should be used. When surveyed in 1998–1999 it was found that only 45 to 50 percent of teachers reported using any set of standards—national, state, or local—to guide their classroom lessons (Holtzman, 2000, chapter 5). Also,

Different people use the term standards to refer to different documents. For example in discussing the "state standards" some were talking about the 1997 State-Board-adopted standards whereas others were talking about, say, the 1992 Framework. Similarly, some people used standards to refer to the NCTM standards; others meant the state standards, and still others meant their district standards. (Holtzman, *et al.*, 2000, p.59)

(Holtzman et al., 2000, p. 59)

STANDARDS APPLIED TO LEARNING DISABILITIES IN THE CLASSROOM

The 1997 California Mathematics Standards were described by some teachers as too rigorous to be met. If this is true for the typical student, how much more difficult are the new requirements for the LD student? The literature reviewed in this study gave no indication that the typical classroom teacher has been made aware of the general recommendations made by experts who research mathematics instruction for learning disabled students. Many who study the effects of mathematics standards agree that either national, state, or both sets of standards limit effective and equitable education for students in mainstream classrooms. (Carnine, 1997; Jacobs, 2001; Klein, 2003). This situation has been attributed to the lack of research by the NCTM into the learning disabled students' needs, or to the omission of consideration for the Dixon Report (1998) recommendations regarding learning disabled students' needs when preparing the State Standards (Carnine, 1997). Many researchers of learning disabled needs in the classroom agree that the solution rests in the adaptation of standards to meet LD needs that result in "hybrid" models of methodology that lean toward Direct Instruction.

PROFESSIONAL DEVELOPMENT IN MATHEMATICS

This is the one area that both progressivists and traditionalist ideologies agree must be supported. The traditionalists call for additional content knowledge in preparation for teaching, while the progressivists require more preparation in constructivist methodology. But both groups of experts insist that mathematics teachers should continue professional development throughout their teaching careers if they are to be effective in the classroom.

These five themes provided the foundation and direction for the data collection process developed for this study.

SUMMARY OF DATA COLLECTION PROCESS

A 21-item questionnaire was administered to 19 educational therapists and the responses evaluated. The results were organized into response categories that related opinion, awareness, behavior, or demographic information. The 19 sets of responses were also examined for trends within the subjects such as years in education, experience within

the public schools, and levels of professional experience within the Association of Educational Therapists (AET).

Next, three experts were interviewed: Sarah Harris MEd, special education classroom teacher and learning disability specialist; Kimberly Mayfield, EdD, coordinator, educational specialist, Mild/Moderate Credential Program at Holy Names College in Oakland, California; and Kate E. Gallaway, MA, educational therapist and mathematics specialist in the private practice Live2Learn in San Rafael, California. Interviews with open-ended items were used with Harris and Mayfield. An interview consisting of fixed alternative items and including one open-ended item to allow space for qualifications of responses was sent by electronic mail to Gallaway. The interviews were examined for statements that either support or contradict questionnaire responses and for statements that add new information to the study.

Suggested correlations have emerged between the five classroom influences identified in the literature and influences of mathematics standards on the one-to-one clinical interventions identified in the data collected.

RESULTS

Mathematics Standards and Educational Therapy

Based on the five themes drawn from the literature and then evaluated using the responses from 19 educational therapists and three experts, it is suggested that awareness of the positive and negative relationships between the influence of mathematics standards on classrooms and on the one-to-one setting is useful for planning intervention strategies in the following ways:

DISAGREEMENT ABOUT GOALS OF MATHEMATICS INSTRUCTION

Knowledge of the history and evolution of mathematics standards and their changing content provides insight into the variety of requirements that the students must meet in mathematics classrooms. Knowledge of the mathematics standards used in the classroom helps the educational therapist plan interventions that are of benefit to the client when taking state standardized tests. Awareness of the approaches used in the client's classroom as compared to those recommended by educational researchers who specialize in learning disabilities also benefits the educational therapist when selecting the most effective mathematics intervention strategies.

The study found that there is little disagreement regarding the traditional direct instructional approach used by the educational therapists who chose to indicate their methods of instruction in the questionnaire. But more than half of the educational therapists did not identify an approach. According to Kate Gallaway there is a shortage of educational therapists

who are trained and confident enough to intervene in what is often the student's most hated subject. For educational therapists who wish to consider mathematics intervention in their practice, a starting point for exploratory discussions would be to understand the key role that political and academic disagreements have had, both in the creation of mathematics standards and in the development of mathematics classrooms that are distinguished by the requirements to reach historically uncertain, rapidly changing goals.

IDEOLOGICAL PREFERENCE

Knowledge of the evolution of mathematics standards allows the educational therapist to recognize that the pedagogic environment in the classroom may be produced by one of the two prevailing ideologies, progressive or traditional, by a combination (hybrid) of both, or by a teacher-made mixture of many ideological perspectives. Understanding the ideological environment of the classroom in the context of the student's diagnosed needs helps the educational therapist identify how any gaps in the student's ability to understand may be related to the particular pedagogic method of instruction.

The responses by educational therapists to the questionnaire items suggest that their pedagogic style is more flexible than that of the classroom teachers, who are often more invested in the constructivist methods of teaching. But, similar to that of the classroom teacher, the educational therapist's pedagogic approach is influenced by the methods taught during his or her professional training.

CONFUSION OVER THE TERM "STANDARDS"

Often the student is required to meet both state and local school district goals for mathematics achievement. A thorough understanding of the contents of various mathematics standards, and of the influence (or lack of influence) that specific mathematics standards have in the student's classroom helps the educational therapist create an intervention plan that is aligned to the mathematics achievements required of the student.

PROFESSIONAL DEVELOPMENT

The experts agree that continuing professional preparation and development is necessary for those who intervene in mathematics. Johnny Lott, president of the NCTM, believes the time has come to establish programs that produce mathematics specialists. All three experts, Sarah Harris, Kimberly Mayfield, and Kate Gallaway, agree that an optional mathematics program would benefit educational therapists who intervene in mathematics. Over half of the educational therapists surveyed agree that more mathematics study is needed. The study of the history of mathematics reform movements, with an emphasis on California's Math Wars and

on the contents of the resulting state mathematics standards, would provide the educational therapist with a solid understanding of the scope and sequence required by the state for mathematics achievement in the classroom.

THE REACTION TO MATHEMATICS STANDARDS BY EXPERTS

This is another reason it is important that educational therapists understand the goals of mathematics standards. Many of those who research the effects of mathematics on learning disabled students in the classroom are recommending approaches to mathematics instruction that combine traditional methods and goals with the principals and practices of constructivisms. These researchers have put out a call for all those who teach students with learning differences to participate in the formation of these approaches. "A collaboration is desirable between special education and mathematics education, whereby the techniques and findings of both fields would be shared and interrelated" (Parmar, 1997).

DISCUSSION

The Association of Educational Therapists Code of Ethics defines the practices and principles that members of the AET are directed to uphold, advance, and strive to reach. This document obligates the educational therapist to strive to include *any means* that will benefit the client. As early as 1973 Ann Ansara suggested that language therapists would be appropriate mathematics tutors. John Crawley and James Miller (1986) offered insight into how the educational therapist can evaluate the client's mathematics performance to gain useful information for the development of an intervention plan. Dorothy Ungerleider (1995), founding president of AET, identifies mathematics as "A fertile diagnostic 'playground,' leading me to new insights and verifying old ones ... math is affected by memory functions, visual, auditory and perceptual-motor processing, spatial orientation, language, thinking and attention—our whole diagnostic 'ball game' so to speak." Her article gives examples of how math can and should be used as a "partner in the diagnostic process..."

These educators have found that assessment of the client's mathematics performance in relation to the method of instruction presented in the classroom is a valuable tool for the identification and remediation of learning difficulties, an objective that is the essence of educational therapy. Whether or not mathematics intervention is offered, the information learned through formal and informal mathematics assessment, including observation of the client's mathematics performance in the classroom, is useful for identifying specific areas of learning weakness that may be interfering with general academic achievement.

The original goal of this study was to learn the extent of knowledge that educational therapists have of mathematics standards and determine how this knowledge

informs their practice. The literature review, along with responses to the questionnaire and the interviews, strongly suggests that in light of the rigorous and often confusing mathematics standards there is a growing need for informed remedial intervention. The questionnaire responses and interviews suggest that there is an awareness of the standards and of the recommended methods of instruction for learning disabled students among those who actively offer mathematics intervention.

But the omission of responses by many educational therapists suggests an uncertain interest in mathematics intervention among educational therapists in general. Of the 37 subjects sent questionnaires, only 19 chose to respond. Of those 19 subjects only 8 indicated an awareness of the mathematics standards used in California and described how this awareness has informed their practice when planning intervention strategies. Although this group represents only a little more than 20 percent of the original 37 surveyed, the responses also suggest that this group understands the recommended methods for mathematics intervention as well as the issues raised by mathematics standards as they apply to learning disabled students. More than half of those surveyed in this study report an interest in the development of standards of practice in mathematics. Each of the three experts interviewed indicated that she supports professional development of mathematics instruction for educational therapists. The literature identifies a need for those who intercede in the one-to-one setting with learning disabled students in mathematics to become partners in research and development of "hybrid" approaches to instruction within the classroom.

One major unanswered question that has arisen as a result of the responses to this study is how, as professionals, can educational therapists most efficiently serve clients with mathematics difficulties?

RECOMMENDATIONS: AET STUDY GROUP FOR MATHEMATICS

Based on the mandate in the AET Code of Ethics, the historical precedence of mathematics remediation in educational therapy, and the responses of educational therapists to this study, it is recommended that a study group be formed to investigate the interests and concerns of educational therapists in relation to mathematics intervention in the one-to-one setting. It is suggested that the AET create an online link at its web site to facilitate a virtual mathematics study group for all interested members and allied professionals. Group members will be notified of information meetings and will participate in research for the purpose of identification and compilation of strategies, materials, and web sites relevant to the study of mathematics in respect to educational therapy. It is also proposed that this group meet at the next AET conference in Las Vegas on February 2005 to present the results of these efforts.

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