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ABSTRACT

Adaptation and modification of science instruction for students with special needs requires collaboration between all educators involved in delivering the curriculum. Further, the collaboration between educational professionals in elementary and secondary schools can be effectively modeled in teacher education programs. This paper describes efforts to demonstrate for a class of preservice elementary teachers the teamwork and effective instructional strategies necessary to meet the needs of all learners. (WRM)

MODIFYING HANDS-ON SCIENCE LESSONS FOR STUDENTS WITH SPECIAL NEEDS: A MODEL OF COLLABORATION

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Essential Factors for Effective Adaption and Modification

Adaptation and modification of science instruction require collaboration between all educators involved in delivering the curriculum. Collaboration is not an activity but a style professionals choose to use to accomplish shared goals (Cook & Friend, 1993; Friend & Cook, 1996). In this case the goal is to educate all students to become members of a scientifically literate society by actively engaging in inquiries that are interesting and important to them (National Research Council, 1996). To achieve this shared goal, educators who work collaboratively must trust and respect each other, believe their contributions are equally valued, share their resources, their responsibilities for making decisions, and the accountability for outcomes (Cook & Friend, 1993; Friend & Cook, 1996). The collaboration between educational professionals in elementary and secondary schools can be effectively modeled in teacher education programs.

Systemic science reform is guided by the principle that science is for all students, and that learning science is an active process. Science is a system of knowing the universe. An understanding of science offers personal fulfillment and excitement - benefits that should be shared by everyone (NRC, 1996). Effective science teachers use the constructivist learning theory that suggest that knowledge is most effectively acquired by evoking personal meaning in the learner. From a constructivist viewpoint, conceptual knowledge is constructed by learners over time within a meaningful social setting (Adams, D., & Hamm, M. 1998). Cooperative learning activities, group problem solving, peer and cross-age tutoring are now generally accepted as useful tools for helping students get the most out of inquiry-based science program. This cooperative interaction with others is an important element in giving all students an opportunity to make sense of what they are learning (Tobin, Tippins, and Hook 1992).

Foundation of the Collaboration

The need for collaboration was identified, based on the career experiences and needs of the authors as classroom teachers then district supervisors then college professors. Houtz's experience as an elementary and middle level science teacher with the mainstreaming or inclusion of students with special needs, made the need clear to her for appropriate modifications to lessons and instructional techniques to ensure success of all students. Later, as a district science supervisor, science teachers expressed the same concerns. In particular, the teachers wanted to meet the individualized education outcomes of students with special needs, while

aiming for excellence and maintaining the integrity of their science program, not "watering it down."

Watson's experience as a K-12 special education teacher and supervisor, involved with both mainstreaming and inclusion, showed her that, even though students might be well-behaved in a science classroom, they often needed assistance from the special education professional. Students with special needs struggled when modifications and adaptations were not made to attend to their learning challenges.

As professors preparing the same students to become teachers in inclusive classrooms, the need was evident to model collaborative efforts in modifying instruction for students with learning disabilities. Houtz and Watson sought to demonstrate the teamwork and effective instructional strategies necessary to meet the needs of all learners.

Efforts to work collaboratively were facilitated by a block schedule in which the pre-service elementary teachers studied science methods, math methods, and special education methods together during the same semester. Pre-service secondary science teachers also studied science methods and special education methods in the same semester. The instructors had similar work schedules and habits, and offices in proximity. An ease of communication existed, based on mutual trust, respect, and parity. Both recognized each others' role, worth and expertise that filled the other's knowledge gap. They shared the belief that collaborative effort is beneficial to the Preservice Teacher and to the students they will teach.

Procedures

Houtz, the science methods instructor, selected a hands-on /minds-on science activity with relevant science content that involved several process skills in the inquiry. The lesson was one with which she was familiar and comfortable and that elementary and middle level students as well as pre-service teachers found captivating and enjoyable. The original lesson plan had been easy enough for children of average ability and reading skills to manage. However, students with learning challenges needed assistance or relied on other members of the group to follow the instructions.

Figure 1
Original Lab Sheet

TITLE: DRACULA'S DILEMMA

PURPOSE: _____

PROBLEM: Dracula complains of experiencing terrible reactions after biting certain victims. He needs to learn about universal donors and universal recipients to avoid mixing his blood with that of mismatched "donors."

MATERIALS:

Clear (O), blue (B), red (A), and purple (AB) colored water (250 mL each)
5 test tubes and a test tube rack

PROCEDURE:

1. Fill each of four test tubes half-full with water from each of the four beakers.

2. Label the test tubes to match the labels on the beakers. For our purposes, the different colors of water will represent the four major blood groups.

3. Use the fifth test tube to add red (tube A) water to each of the labeled test tubes. Check for any color changes. Mark the data sheet with a (-) to show color change, and with a (+) if there is no color change. You are looking for total color changes - bluish-purple or reddish-purple is still purple.

4. After recording your observations, rinse out all five test tubes.

5. Repeat the procedure three times, using the fifth test tube to add a different color of water to the labeled test tubes each time.

6. Complete the data table and answer the questions.

DATA Donor

Recipient

	A	B	AB	0
A				
B				
AB				
0				

A color change (-) means blood-type incompatibility; no color change (+) means blood-type compatibility.

Questions

1. Which blood type is the universal donor? _____

2. Which blood type is the universal recipient? _____

3. The Frankenstein monster has type-B blood. Dracula has type-O blood. Can the monster give blood to Dracula? _____

4. The Werewolf has type-AB blood. Can he receive blood from the Frankenstein monster?

____

As Director of Special Education, Watson looked over the lesson as written and asked herself, "How would I teach this?" As a non-science person with English as her second language, she looked critically at what it would take to make this particular lesson more manageable and relevant for herself and for students with special needs. Watson shared her expertise with Houtz and their mutual students regarding adaptation and modification of instruction based on the knowledge of several areas of difficulties exhibited by a great number of students with disabilities. Educators need to understand how those areas of functioning affect students' performance and inhibit their success in school (Mastropieri & Scruggs, 1992; Scruggs & Mastropieri, 1994; Wood, 1998).

The science objectives were clearly identified and remained intact. Watson made specific modifications of the lesson on knowledge of the characteristics and needs of the special education student. The basic procedures remained the same. However, different levels of learning and achievement of the lesson objectives were indicated.

Figure 2
Planning Pyramid

What SOME students will learn	Type O is the most sought-after blood type for transfusion
What MOST sutdents will learn	There are 4 basic blood types: A, B, AB, and O. Type O is the universal donor. Type AB is the universal recipient.
What ALL students should learn	There are different types of blood. Some blood types cannot be mixed with other blood types.

Together Houtz and Watson collaborated on making appropriate and broad-ranged modifications, including appropriately sequencing the procedure steps, detailing and illustrating the materials needed, and clarifying the language and wording of questions. The modified lesson appears as an appendix at the end of this paper.

Watson and Houtz made a joint presentation to their shared pre-service teachers. Each explained her role and experiences. Watson detailed characteristics of students with special needs, elaborating particularly on learning disabilities and specific appropriate modifications to instructional techniques typically used in a science classroom.

Houtz introduced the "Before" and "After" science lesson, pointing out that the science objectives remained the same, but the approach and the activity sheet had extensive modifications to aid all students. The pre-service teachers proceeded with the hands-on/minds-on activity, following the lab sheet with revisions.

Throughout the semester, Houtz and Watson communicated on objectives and procedures in their classes. Houtz shared the lessons modeled in science and mathematics methods classes; Watson then assigned their mutual students to make appropriate modifications for students with specific needs.

The pre-service teacher's learning was assessed not only by the lesson plans they modified or created for students with special needs, but also by their performance implementing appropriate teaching strategies in practicum settings.

Conclusion

Collaboration is expected between classroom teachers, special education teachers, and other professionals in the child's learning environment. This collaboration can be effectively modeled in teacher education programs when the importance of these efforts are recognized and the opportunities are available. Successful collaboration existed in this teacher education program because all parties were guided by the principle that science is for all students. The teacher educators for both science/math methods and special education methods utilized the opportunity to communicate and collaborate in offering their pre-service teachers a dynamic and

pragmatic modeling of effective teamwork. This approach provides teacher education programs ideal opportunities to meet many of the criteria to meet the National Science Education Standards Professional Development Standards B and D (National Research Council, 1996). More importantly, it can move students with special needs in the direction of scientific literacy along with their classmates in inclusive elementary and secondary settings.

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