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The Impact of Dissemination Workshops on Educator Attitudes Toward Teaching Scienceto Students with Disabilities: Don't Discount Short Term Interventions?

Abstract

This report presents findings of short-term one time staff development workshops on inclusive teaching in science classrooms. This study investigates k-12 teachers, special educators and administrators in the area of teaching science to students with disabilities. Data came from four surveys: 1) three surveys conducted in 2002 included participants in workshops from 12-40 hours in different formats, and 2) a survey conducted with non-participant educators. Statistical analysis reveals that all three treatment groups were significantly different from the non-treatment group. Significant differences were not found between the three treatment groups. Regardless of the workshop format and certification or teaching areas, attendees had more positive attitudes toward teaching science for each of the four areas investigated: Attitudes About Students, Work-Related Dispositions, Post-Secondary Dispositions, and Work-Related Performance.

Narrative comments indicate the participants made changes in instructional strategies, made laboratories and outdoor areas accessible, and modified assessment approaches based on the knowledge acquired in the workshop. A number of the respondents indicated they helped other professionals or worked directly with students to develop self-advocacy skills, delivered of pre-service and in-service workshops, taught courses for peers and pre-service teachers, made presentations at meetings and conferences, engaged in grant activities, and participated in research and curriculum development activities following their workshop attendance. Increased collaboration was especially strong among those in Group A who participated as a workshop team.

The evidence from this study indicated that short-term dissemination workshops can significantly impact educators' preparedness, responsiveness to make accommodations, and attitudes towards including students with disabilities in regular classrooms. For many, the workshop experience encouraged them to share their talents and abilities with others to better educate all students.

The Impact of Dissemination Workshops on Educator Attitudes Toward Teaching Science to Students with Disabilities: Don't Discount Short Term Interventions?

Introduction

In recent years training models of staff development involving theory and demonstration have been criticized as not being effective in skill acquisition and on-the-job application. Quoting directly from Speck and Knipe (2001, p.84), they stated, "Researchers have reached a clear consensus that onetime workshops for teachers are ineffective. The content is not transferred to the classroom, nor does it affect student achievement." They anchor that statement on the seminal publication of Joyce and Showers (1995) who stress the importance of practice, feedback and coaching. A similar but supporting statement came from Darling-Hammond, Ancess and Falk (1995), who reported that teachers' individual efforts, in random isolation, had not provided the power to move student achievement in significant ways. They implied there was very limited professional impact without sustained long-term district-wide initiatives and the inclusion of coaching in the process. Joyce and Showers are often cited as reporting that only 5% of teacher apply a theory following presentation of the theory, while 10% make the application after modeling is included, and up to 15% if practice and feedback are in a presentation. Joyce and Showers claimed that when coaching was added, 80-90% of the teacher participants applied the theory.

However, the research is not as consistent as implied in these statements. Strong evidence can be found that teachers can and do change their practices with brief targeted workshop experiences. Duffrin (2002) indicated that teachers are more likely to buy into training that they helped design or select. It is important that the teacher feels a need and a readiness to learn something. McLeskey and Waldron (2002) reported that teachers involved with inclusive school programs perceive two important aspects if they were to improve classroom practices in the general education classroom. These changes were to modify the curriculum to enhance the relevancy for each student and to modify instructional techniques. In the case of addressing instructional needs in inclusive classrooms; Schumm & Vaughn (1995) reported that teachers often said that they lacked the knowledge, skills and confidence to make instructional adaptations for students with disabilities. Furthermore, they reported that adaptations were not implemented in classrooms as frequently as teachers or students would like, and the adaptations tended to be piecemeal rather than consistent and systemic. Speck & Knipe (2001,p. 90) in relating the definition of coach to earlier research, stated:

> Joyce and Showers in their more recent research have reversed their definition of a coach. "The coach is the teacher, not the observer, and the observer is learning from the teacher-not observing the teacher for feedback, but learning from the observed teacher and reflecting on his/her own practice. Joyce and Showers (1995) explained they no longer include feedback as a component of peer coaching; instead they emphasize other aspects of peer coaching in peer study teams, where the primary activity is the collaborative planning and development of curriculum in pursuit of shared goals.

The workshop participants in this study indicated that students who needed adaptations were being placed in their classrooms and the participants lacked an awareness of the research and resources to help them in their teaching. They consistently expressed frustration with administrators and specialists who assigned special needs students to classrooms without teacher consultation or professional development. Participants indicated that both administrators and special educators made statements about teacher responsibilities related to IDEA 1997, but offered only a few suggestions. In general, the participants did appreciate the support of special educators in assisting students with basic

skills, test taking, socialization skills, and reflecting on their choices. However, many of the science teachers had little confidence about getting any significant outside support to improve their skills in teaching science to students with disabilities. They felt they did not know where to get information specific to teaching science to students with disabilities, strategies relating specifically to teaching science, assistance related to teaching in laboratory and outdoor settings, and individuals with expertise and interest in improving science learning for students with disabilities. They generally supported collaboration but felt there was little time and stated the amount of in-classroom support was limited.

To convince teachers to improve their professional skills, it is key to give them a stake and a professional role in the planning. Blandford (2000) outlines six elements of such assistance: providing role models of good practice and attitude, arranging specific guidance/training; encouraging reflection; delegating with sensitivity; promoting developmental initiatives; and providing information and developmental opportunities as they arise. Each of these elements was included in the workshops involved in this study.

Instrumentation

A 44-question attitude survey was used to examine four areas: Attitudes About Students, Work-Related Dispositions, Post-Secondary Dispositions, and Work-Related Performance. Participants were asked to respond on a five-point Likert Scale ranging from Strongly Agree to Strongly Disagree. Twenty-three questions have a negative direction and 21 questions have a positive direction.

The instrument employed in the study was a result of revisions over a 10-year period. An initial instrument was prepared for the first National Science Teachers Association Pre-Conference Workshop in 1992. It consisted of approximately 100 items addressing the four hypothesized factors. Each year participants completed a revised instrument and suggestions were sought concerning the validity and wording of the questions. Efforts were made to reduce redundancy and focus questions on the four hypothesized factors. In 200, a content analysis resulted in the 44-question survey with 11 questions in each category. Content validity evidence was obtained based on feedback from practitioners, authorities, and grant recipients who used the instrument in their evaluation process. Internal consistency estimates of reliability (Coefficient alpha) for the entire instrument (.96) and each of the subscales

(Attitudes About Students = .85 , Work-Related dispositions = .84 , Post-Secondary Dispositions = .85 , and Work-Related Performance = .91) was uniformly high.

In addition to the attitude survey, information was collected on how participation in the workshops affected participants future professional behaviors and their interactions with students. Respondents in groups A and B shared narrative comments about activities they did within their building; activities they did within their district; contributions they made at the state, national or international levels; presentations they made, grant involvement, and other comments they wished to share. The participants in Group C will receive a follow-up survey in May 2003.

Subjects and Methodology

Data for this report were drawn from attitude surveys administered to workshop participants and non-participants collected over a 10 year period. Three different groups of participants received short-term staff development workshops: science teacher-special education teacher teams that participated in a two-day training workshop between 1996-1998 (Workshop A); attendees at two-day National Science Teacher Association pre-conference

workshops conducted from 1992-2001 (Workshop B); participants in a 40 hour, 11 day workshop taught on a Fiber Optic Network at seven sites in June, 2002 (Workshop C). Subjects in the non-participant comparison group were composed of a sample of 50 elementary teachers , 25 middle level teachers, 25 high school teachers, 25special education teachers, and 25 administrators. Surveys were distributed and collected during in 2002. The pre-test scores of the participants in Workshop C were also included. (Non-Participants)

The representative sample for Worshop A included surveys mailed to 61 science teacher-special education teams in October 2001. At least one member from 35 of the teams responded yielding a team response rate of 55.3%. The total number of returns was 56, yielding an individual response rate of 45.9%. In two instances a single survey was returned representing a consensus return from the team members. The workshops were conducted in four locations during the 1997-98 school year. Seven questionnaires were returned as being undeliverable due to a school closing or team members no longer teaching in the building or district. It can be assumed that there may have been other cases where the questionnaires were discarded and not returned.

The representative sample for Workshop B included surveys mailed to 282 individuals participating in two-day Pre-Conference Workshops offered annually from 1992-2002 prior to a National Science Teachers Association Annual Conference. Twenty-two survey packets were returned as undeliverable. As in Sample A, it can be assumed that there may have been other cases where the questionnaires were discarded and not returned. The return rate for this sample population was 43/260 or 16.5%.

The representative sample for Workshop C included pre- and post-test responses to the attitude survey of 34 participants in a 40-hour summer workshop offered in the Summer of 2002. All of the participants responded to the survey yielding a return rate of 100%. This allowed a more exacting measure of the impact of the workshop activities on respondent attitudes and behaviors.

Students participating in an undergraduate research project distributed the surveys to non-participant educators. Returns were 46/50, or 92%, for the elementary teacher sample; 21/25, or 84%, for the middle school science teacher sample; 15/25, or 60%, for the high school teacher sample; 16/25, or 64%, for the special education teacher sample; and 14/25, or 56%, by the administrator sample. In some cases the special education teachers and administrators elected not to respond because they didn't see themselves having any direct role in science teaching. A similar response was given by some of the high school teachers who taught advanced classes and stated that special needs students were very rare in their classes. Pretest scores of the students in Group C were also included in the Non-Participant Sample.

Data Analysis

Separate one-way ANOVA's were performed on each of the four attitude sub-scales, as well as the overall total score. The mean values for each group on each of the sub-scales and overall total are noted in Table 1.

Table 1

Mean Scores and Standard Deviations ( ) of Participant (Workshop A,B,C) and Non-Participants on Four Sub-Scales of a Survey about Teaching Science to Students with Disabilities

Group	Attitude About Students	Work-Related Dispositions	Post-Sec Dispositions	Work-Related Performance	Overall Mean
Workshop A (n=56)	4.28(.41)	4.27(.38)	4.23(.43)	3.89(7.1)	4.12(.40)
Workshop B (n=43)	4.17(.36)	4.20(.40)	4.35(.38)	4.12(.63)	4.22(.35)
Workshop C (n=34)	4.25(.38)	4.24(.38)	4.31(.33)	4.26(.53)	4.28(.35)
Non-participants (n=154)	3.89(.47)	3.89(.49)	3.53(.51)	3.34(.92)	3.68(.49)

Analyses of variance tests were statistically significant for each of the subscales (Attitudes of Students, $F(3, 284) = 12.74$, $p > .01$; Work-Related Dispositions $F(3, 284) = 11.64$, $p > .01$; Post-Secondary Dispositions $F(3, 284) = 55.18$, $p > .01$; Work-Related Performance $F(3, 284) = 18.15$, $p > .01$) and the overall score ($F(3, 284) = 12.19$, $p > .01$), indicating differences among the four groups. Follow-up post-hoc pairwise comparisons (Tukey HSD) indicated that the three participant groups (Workshop A, B, and C) differed significantly from the non-participant group on each of the four subscales. No statistically significant differences were found between the participants in the different workshop formats.

Separate Post-Hoc comparisons were made for the different teaching levels and certification types of the participant and non-participant samples. Analyses of Variance Tests were significant $F(9,257)= 72.94$, $p > .01$, between participants and non-participants. The ANOVA analysis produced a significant result $F(9,257) = 15.13$, $p > .01$, on the effect of teaching level. The participants were significantly higher than the non-participants across all certification and teaching levels.

Non-participant and participant ( ) group respondents from the different certification or teaching categories were compared on four sub-scales: Attitudes About Students, Work-Related Dispositions, Post-Secondary Dispositions, and Work-Related Performance. The data are shown in Tables 2 and 3.

Table 2

Mean Scores and Standard Deviations of Non-Participant ( ) Respondents on Four Sub-Scales and Total Score on a Survey about Teaching Science to Students with Disabilities

Teaching Level	No.	Attitude About Students	Work - Related Dispositions	Post-Secondary Dispositions	Work - Related Performance	Overall Mean
Elementary	66	3.86(.59)	3.80(.58)	3.39(.55)	3.24(.85)	3.58(.57)
Middle Level	29	3.93(.33)	3.93(.35)	3.63(.44)	3.34(.91)	3.73(.38)
High School	19	3.88(.33)	3.94(.29)	3.34(.36)	3.08(.83)	3.59(.31)
Special Education	27	4.07(.38)	4.17(.43)	4.05(.41)	3.95(.90)	4.09(.41)
Administration	14	3.72(.28)	3.80(.49)	3.44(.31)	3.23(.106)	3.56(.40)

Analyses of variance tests were statistically significant on two of the subscales and on the overall attitude (Post-Secondary Dispositions $F(4,204) = 10.97$, $p > .01$; Work-Related Performance $F(4,204) = 3.89$, $p > .01$) and the overall score ($F(2,204) = 6.22$, $p > .01$), Follow-up post-hoc pairwise comparisons (Tukey HSD) indicated that special education teachers had more positive Post-Secondary Dispositions than elementary teachers, middle level teachers, high school teachers, and administrators. On the area of Work -Related Performance special educators' self-reported better performance than elementary and high school teachers. On overall average scores, special education teachers had more positive attitudes than elementary teachers, middle level teachers, high school teachers, and administrators.

Table 3

Mean Scores and Standard Deviations of Participant Respondents on Four Sub-Scales and Total Score on a Survey about Teaching Science to Students with Disabilities

Teaching Level	No.	Attitude About Students	Work - Related Dispositions	Post-Secondary Dispositions	Work - Related Performance	Overall Mean

Elementary	41	4.29(.40)	4.27(.40)	4.33(.37)	4.20(.48)	4.28(.34)
Middle Level	19	4.13(.44)	4.16(.35)	4.20(.36)	4.01(.65)	4.14(.38)
High School	17	4.08(.29)	3.94(.31)	4.18(.27)	3.76(.50)	4.00(.24)
Special Education	24	4.36(.38)	4.38(.33)	4.30(.50)	3.99(.86)	4.27(.43)
Administrators	11	4.15(.24)	4.40(.38)	4.51(.29)	4.45(.62)	4.38(.34)

Analyses of variance tests were statistically significant on one of the subscales (Work Related Dispositions $F(4,218) = 4.43$, $p > .01$. Follow-up post-hoc pairwise comparisons (Tukey HSD) indicated that special education teachers had more positive Work-Related Dispositions than secondary teachers. No other statistically significant differences were found between the participants in the different certification or teaching categories.

The 34 participants in Group C completed the attitude scale prior to the 40-hour workshop and immediately following completion of the workshop. The mean scores on each sub-scale, standard deviation, *t*-score, and significance are shown in Table 4.

Table 4

Differences between Pre-Test and Post-Test Average Sub-Scale Mean Scores of Respondents Participating in a

40-hour Workshop on a Survey about Teaching Science to Students with Disabilities

Category	**Pre-Test Mean**	**Post-Test Mean**	**Standard Deviation**	***t*-Score**	**Significance**
Attitudes Toward Students	3.60	4.00	.33	6.98	.01
Work-Related Dispositions	3.87	4.15	.40	4.19	.01
Post-Secondary Dispositions	3.62	4.19	.43	7.79	.01
Work-Related Performance	3.83	4.23	.45	5.40	.01

Significance was indicated on all of the sub-scales following participation in the workshop. After participation, the participants had more positive Attitudes Toward Students, better Work-Related Dispositions, more positive Post-Secondary Dispositions, and better Work-Related Performance.

Discussion

The data and findings in this study challenge the blanket criticism of the ineffectiveness of short-term one-time workshops. A lot depends upon the purpose of the workshop, the context, and the participants. The data analysis from each of the workshops conducted in this study indicate significant improvements in teaching attitudes and performance relating to the teaching of students with disabilities.

One of the advantages of the workshop format is to allow outside expertise into the arena of educational reform initiatives. Lieberman and Miller (1999a) report that it is critical to balance the use of inside and outside expertise and research to inform professional practice in schools. Educators credit their out-of-school professional development, in the company of other reform-oriented subject area teachers, with enabling them to act on the premise that new ways of approaching the subject would result in greater student participation and success. (Lieberman and Miller, 1999b). Speck and Knipe (2001) emphasize the need for rich examples and modeling embedded in subject areas. They stress the importance and value of subject specific staff development and the need to address how the new information and strategies can be used to affect teaching and assessment in a particular subject matter area.

Hargreaves and Fullan (1992) share the importance of a "nudge" in bringing about teacher motivation to change and grow. They emphasize that it might be a minimum condition - some slack, variety, challenge, or an opportunity to seek out a professional development opportunity - that may be the inducement to seek out greater career satisfaction and commitment. The freedom to go back into their classroom to experiment with skills that emerge from discussions and observations is important. Teachers need opportunities to tinker and fit their new knowledge and skills into their working context. Guskey (2000) states that the most worthwhile changes in education require time for adaptation, adjustment, and refinement. For example, teachers almost always gain better results in the second year of implementation than they do the first. The first year is a time of experimentation. By the second year, efforts are typically more refined and efficient.

Participants in sample A were responsible for conducting a follow-up workshop within their own building and or district. It appears that the model employed was quite effective as shown from their willingness to respond to the survey and in changes in attitude reflected in responses to the individual questions. Lieberman and Miller (1999) emphasize the value of having teachers serve as presenters following participation in a workshop. This is further supported by Lambert (1998), who states that encouraging leadership by teachers recognizes their expertise, which can be used to help others, and builds the capacity of the school and district. The participants in Sample C are responsible for conducting a follow-up workshop with teachers in their district during the 2002-2003 school year.

Efforts were made to include administrative personnel in all of the workshops. In groups A and C a prior administrative commitment was made to provide time in the in-service schedule for participants to conduct a follow-up workshop. Each of the workshops in group B had at least one line administrator as a participant. In addition to providing valuable input from a different perspective, their role can help bring about school improvement and services to students with disabilities. Their participation and involvement is emphasized in the research. When administrators help acquire resources, including structured time to collaborate and share, they send an important signal that pays rich dividends (Guskey, 2000; Schmoker, 1996: Fullan, 1993).

One of the apparent effects of the workshops is evidence that the participants have acted upon the workshop experience to share their ideas with others. Terehoff (2002) reports a

dramatic increase in self-concepts when people make a transition from being a learner to a producer or doer. Professional development is necessary for teachers and administrators at all levels if they are to learn new roles and succeed in them. The ultimate goal is improved learning for students. Although this research investigation did not measure student outcomes, the feedback from the participants reflects improved attitudes and greater commitment towards meeting the needs of all students

Group A Responses

The narrative comments from the 56 science teacher-special education teacher team respondents in Group A indicate that the workshops, impacted the individuals involved, and had a significant impact on the greater educational community. Essentially all of the individuals involved as team members had basic classroom responsibilities either as a regular classroom teacher or special education teacher. Their involvement in outreach lends an important knowledge multiplier because the workshop experience affected their willingness to share their improved skills with other educators.

The most frequently cited action (15 respondents) is increased collaboration. Modifications in instruction, alternate assignments, or extended hours for laboratory access are mentioned eight times. Improved access for students with disabilities by modifying equipment was noted by seven individuals, two others made statements about improving outdoor access for students with disabilities on field sites or field trips, and four individuals referenced improved access in the workplace or in their office. Serving in an advocacy role was mentioned six times and modeling for pre-service teachers was mentioned twice. Thirteen individuals indicated they participated in presentations - nine at the district level, two at the state level, and two nationally. Participants noted involvement in external funding with three district, two state, and six federal level grant awards being cited. Four individuals noted that they were involved in the preparation and publication of curriculum materials or resources for teachers.

Group B Responses

The 43 responses from participants in the National Science Teachers Association Pre-Conference Workshops, Group B, reflect participants with a variety of backgrounds, positions and interests. Each of the pre-conference workshops included a few individuals who had National Science Foundation supported projects as presenters or participants. One cannot ascertain from the narrative comments whether the workshop encouraged those activities or whether the workshop provided a forum for the individuals to share their knowledge and enrich their skills. In either case, participant contributions clearly impacted the greater educational community.

Thirteen individuals indicated changes in teaching strategies to accommodate all students, eight references were made to using assistive technologies or modified equipment. Three individuals noted assessment modifications. Five references related to assisting with the implementation of ADA, three noted working with the local office of Disabled Student Services, and four mentioned screening science laboratories for improved access. Two described modifications in outdoor laboratory areas, and two indicated that they had changed workstations.

Over 25 of the respondents in Group B indicated that they were involved in some form of in-service delivery resulting in scores of staff development programs, and six noted work with pre-service teachers. Sixteen individuals indicated they had made conference presentations. Over 20 mentioned that they provided help and support to other professionals. There is reference to 16 federal grant awards and 19 awards at the state level. Fifteen individuals indicated they are involved developing curriculum materials and 14 commented on research

activity. One individual mentioned the development of a CD', one noted his/her work in distance education, and one indicated improved access in informal science settings.

Conclusions

Statistical analysis revealed that regardless of the workshop format and certification or teaching areas, attendees at workshops on teaching science to students with disabilities have more positive attitudes on each of the four areas investigated: Attitudes about Students, Work-Related Dispositions, Post-Secondary Dispositions, and Work-Related Performance. The participants were significantly higher than the non-participants across all certification and teaching levels. The findings of this survey indicate that most respondents made significant changes in educational practice as a result of a workshop experience. For many the workshop experience was a stimulus to share their talents and abilities with others for the betterment of education for all students.

The post workshop scores of other workshop participants were compared to a non-participant sample, whereas the pre-test and post-test responses of the participants in Workshop C provide an exacting measure of the impact of the workshop activities on respondent attitudes and behaviors. The fact that similar results were obtained for all participant groups across the different workshop formats provides evidence for the continuing need of dissemination workshops for educators on teaching science to students with disabilities.

A major finding of the study is that a dissemination workshop that addresses the needs of science teachers about teaching science to students with disabilities produces significant positive changes in attitudes towards students with disabilities for all participants, brings about higher gain scores for those least informed, and reduces differences between different groups of educators. There were several noted differences between special educators and other personnel prior to the workshop experience. Special education teachers had more positive Post-Secondary Dispositions than elementary teachers, middle level teachers, high school teachers, and administrators. On the area of Work-Related Performance special educators' self-reported better performance than elementary and high school teachers. On overall average scores, special education teachers had more positive attitudes than elementary teachers, middle level teachers, high school teachers, and administrators. Following the workshop the only noted significant difference was between special educators and high school teachers on one sub-scale, Work-Related Dispositions.

The narrative comments indicate that many of the participants are actively helping other educators through professional presentations, delivering workshops and in-service programs, and writing grants for external funding relating to improved services for students with disabilities. One might challenge the significance of the workshops in providing a stimulus for all of the actions noted above. However, the workshops in addition to the knowledge and skills imparted to the participants resulted in improved collaboration and communication among those committed to improve the education of students with disabilities in science. Ample evidence is seen in both the quantitative data and narrative comments that, contrary to criticisms of short-term professional development programs shared in the literature, dissemination activities play an important role in meeting our goals toward greater equity in education. Workshops such as the ones investigated in this study serve an important role in the continuing professional development of educators.

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Appendix C

Survey of Participants About Teaching Science to Students with Disabilities

2002-2003

I. Actions that respond to the needs of all students.

Please circle the number that best represents your level of agreement or disagreement with the following statements.

1=Strongly Disagree

2=Disagree

3=Neutral, neither agree or disagree

4=Agree

5=Strongly Agree

+1. Teachers need special training to overcome prejudices and emotional barriers in working with students with special needs.

-2. Too much money is spent to address the unique needs of students with special needs.

-3. Students with severe special needs should not be allowed in science classes with regular students.

-4. Students with special needs are at-risk concerning safety issues in hands-on science lessons.

-5. Students with special needs increase the risk of other students related to safety in hands-on science lessons.

-6. In the majority of cases, it is best if peers conduct a science investigation with the special needs student as an observer.

-7. It is unreasonable to expect a classroom to be open extra hours to allow the special needs student as an observer.

-8. Special needs categories are too often used as an excuse for student failure.

-9. The attention given to special needs students detracts from teaching the other students.

-10. The regular classroom teacher should not be expected to make major adjustments to serve special needs students.

-11. The primary responsibility for communication concerning special needs students should rest with the special education teacher.

+12. Special needs students gain self-esteem and confidence through science activities.

-13. It is impossible to expect a student with a physical disability to be an active participant in all laboratory exercises.

-14. I wish I did not have to teach science to students with special needs.

-15. I feel inadequate in my preparation for teaching science to a student with a physical disability.

-16. The majority of students with a physical disability also have cognitive impairments.

-17. It is unrealistic to expect a blind student to be a chemist.

-18. It is unfair for a science teacher to encourage a person with severe motor/orthopedic special needs to pursue study in a career that involves active study like marine biology or geology.

-19. Care should be taken not to give special needs students' unrealistic goal expectations that will inevitably result in frustration when they try to find employment.

+20. Outdoor field trips are excellent opportunities for increasing the experiences of students with special needs.

-21. Care must be taken not to really challenge students with physical special needs in science because they are more likely to become frustrated and give up.

+22. All teachers of science should be required to participate in training on teaching science to students with special needs.

-23. I am more comfortable in a setting where there are no people with visual disabilities.

+24. I am aware of sourcebooks for making changes in my classroom environment and my teaching methods in order to accommodate student(s) with disabilities.

-25. It is inappropriate to expect all science methods instructors in higher education to include topics and model lessons in teaching science to students with disabilities.

-26. Faculty in special education should teach methods of teaching science for K-12 students with special needs.

-27. There is no need for specialized methods of instruction in teaching science for students with disabilities in preservice teacher preparation programs.

-28. There is no need for specialized methods in teaching science for students with special needs in staff development programs or graduate classes.

+29. I am aware of general strategies to address students with disabilities in a science classroom or laboratory setting.

+30. I am accepting of student diversity in my own teaching.

+31. I am sensitive to teaching through the mind of the learners rather than expecting students to accommodate to my teaching.

+32. I put forth more effort to work with students who are not responding to instruction to enlist their support and cooperation.

+33. I engage in additional efforts to design, select, or modify activities so that all students can achieve success appropriate with their talents and abilities.

+34. I modify my assessment strategies and formats to allow greater numbers of students to experience a sense of success or accomplishment.

+35. I work closely with parents or guardians to engage in cooperative efforts to serve the best interests of the child.

+36. I utilize Internet resources to seek out ideas that can help me be more responsive to addressing the needs of all students.

+37. I modify my management strategies to make them more appropriate for the student diversity in my classes.

+38. I provide additional laboratory time for students with special needs.

+39. I am accessible to students with special needs outside of regular classroom instruction to respond to their individual needs.

+40. I am aware of safety and legal issues relating to classroom science instruction.

+41. I apply my knowledge of best practice research to improve my own teaching.

+42. I collaborate with other professionals in planning strategies for meeting the needs of all my students.

+43. I work with my students to develop meta-cognitive skills (self-awareness, self-questioning, self-monitoring, self-reinforcement) to assist them in decision-making processes.

+44. I am comfortable in interacting with human diversity in my personal relationships.

Question Distribution: Survey of Participants about Teaching Science to Students with Disabilities

Attitude about Students: 3,4,5,6,8,12,13,16,17,18,19

Work-Related Dispositions: 2,7,9,10,11,14,20,21,23,30,44

Post-Secondary Dispositions: 1,15,22,24,25,26,27,28,29,40,41

Work-Related performance: 31,32,33,34,35,36,37,38,39,42,43

Narrative Questions:

Activities that I have done within the building to improve the quality of educational experiences in science for students with disabilities.

Activities that I have done within the district to improve the quality of educational experiences in science for students with disabilities.

Activities that I have done at the state, national, or international level to improve the quality of educational experiences in science for students with disabilities.

Presentations I have made or participated in related to science for students with disabilities.

Grants I have written or participated as a staff member.

Other comments.