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Teacher Efficacy in Co-teaching Science Classrooms: Implications for Training

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Abstract

Following legislation to educate students in the least restricted environment, schools are using co-taught inclusive settings to teach secondary science classrooms. Traditionally, general educators do not receive robust instruction in differentiation, co-teaching, or collaboration with special educators. Special educators traditionally do not receive training in science content. An online survey was distributed through social media inviting teachers to share their experiences with co-teaching in science classrooms. Likert scales were used to measure teacher efficacy in co-teaching secondary science classes and teacher perceptions of the effectiveness of current teacher training. Based on the data collected, recommendations are provided for adjustments to pre-service teacher training programs and in-service professional development opportunities that can be utilized by teacher educators, school administrators, and school district trainers to strengthen ongoing training and better prepare teachers to co-teach in science classrooms.

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Introduction

The No Child Left Behind Act (NCLB) mandates that all students be assessed based on state standards, including students with disabilities in special education (Arndt & Liles, 2010). The 1997 reauthorization of the Individuals with Disabilities in Education Act Amendments (IDEA) clarified that regardless of the disability, all children should be educated in the Least Restricted Environment (LRE), with first consideration to be inclusion in a general education setting (Dusty & Dinnesen, 2012).

In response to IDEA and NCLB, schools must give students with disabilities (SWD) access to general education curriculum and instruction in grade level concepts (Boyle, 2010, p. 93). One method for meeting this mandate is to partner general education content teachers with special education teachers within the general education classroom. The partner teachers work together to deliver the curriculum with needed support in place. However, there is a gap in addressing and understanding the specific training requirements essential for fostering effective collaboration between general and special educators within a shared classroom setting (Arndt & Liles, 2010).

A science classroom is the ideal environment to create inclusive opportunities due to the hands-on experiences and built in group collaboration (Johnson & Brumback, 2013, p. 9). However, for co-teaching partnerships to benefit students in the shared classroom, both teachers must be able to teach the content and work with them. The general educator (GE) and the special educator (SE) should be able to provide introduction, guided and independent practice, and formative assessment to all students within their classroom (Linz et al., 2011, p. 19).

Purpose

This study explored teacher efficacy in teaching students with disabilities, and perceptions of current training programs. The research highlights the need for pre-service teacher training and in-service teacher professional development for co-teaching practices in science classrooms.

While well versed in scientific knowledge, pre-service science teachers may only receive training that covers types of disabilities and the legal requirements of teaching students with those disabilities. That training often lacks strategies for adapting curriculum to meet a diversity of needs. Conversely, special educators receive training in curriculum adaptation without the context of content specific knowledge.

Both teachers may receive theoretical advice about co-teaching from the lens of their specialty without practical application prior to teaching. Ideally, a co-teaching team would be given adequate training that would allow them to combine the general educator's content expertise with the special educator's pedagogical expertise to enrich the educational experience for all their students (Strogilos & King-Sears, 2019).

The training needed starts in pre-service teacher preparation programs. In some schools, the general and special education departments are in distinct parts of the building, or separate buildings all together. The students, both graduates and undergraduates, rarely set foot in the other department's classes. Arndt and Liles (2010) believe that this separation of special education from general education contributes to issues that arise within co-teaching arrangements. They further believe that all teachers should have practice differentiating instruction, co-teaching, and be able to critically reflect on their practice to make improvements.

Professional development opportunities are also needed for in-service teachers that teach in co-teaching science teams. Dusty and Dinnesen (2012) discovered that there was a lack of use of co-teaching models beyond the one teach-one observe model. This indicated that more training and support are needed for co-teaching teams to expand their repertoire of teaching practices to reach a greater diversity of learners. Dusty and Dinnesen (2012) also suggested ongoing support rather than single event training to sustain effective co-teaching practices within a school.

Context of Study

Through a digital survey, this research study measured the efficacy of in-service secondary science teachers and special education teachers, identified the gaps in training for pre-service and in-service teachers, and discusses ways to close these gaps within co-taught science classrooms. To determine what changes to pre-service training and in-service professional development are needed, this study answered two research questions:

1. What are GEs and SEs perceived self-efficacy in co-teaching instruction in the secondary science classroom?
2. How do GE and SE teachers perceive the adequacy of current pre-service and in-service training for preparing them for effective teaching in a co-taught secondary science classroom?

Explanatory Definitions

- Co-teaching: “two or more professionals delivering substantive instruction to a diverse, or blended, group of students in a single physical space” (Hallahan et al., 2019, p.33). Unfortunately, many schools believe that by assigning a general educator and special educator to the same room, the co-teaching requirement is met. Co-teaching is the

collaboration of both teachers for all the responsibilities within the co-taught classroom (Johnson & Brumback, 2013).

- Least Restricted Environment (LRE): Within the statutes of the IDEA, the LRE is defined as educating children with disabilities with regular children in a regular classroom as much as appropriate. Removal of a child with disabilities from that environment is subject only to cases wherein the learning needs and accommodations of a child could not be met inside a regular classroom environment (Francisco et al., 2020). In this regard, the general education classroom is seen as the least restricted environment, and a special education classroom as the most restrictive environment.
- Pre-service teacher training program refers to a traditional teacher training program, postbaccalaureate program, or career switcher program that leads to teacher licensure.
- In-service professional development opportunities refer to any classes, courses, or training taken after initial licensure is obtained used for additional certification, towards renewal of a teaching license, or for general knowledge.

Literature Review

The number of inclusive co-taught science classrooms are increasing as school systems find ways to meet the requirements of No Child Left Behind (NCLB) and Individuals with Disabilities in Education Act (IDEA). Because they offer a multitude of hands-on activities and group work that can be differentiated to meet the diverse needs of students, science classrooms are ideal learning environments for inclusive practices (Johnson & Brumback, 2013, p. 9).

Students with disabilities (SWD) often have significant gaps in achievement compared to their same-aged peers, and therefore need the support offered within a co-taught science

classroom to help close those gaps (Preston-Smith et al., 2020, p. 29). SWD learning in co-taught classrooms have higher scores in academic achievement, behavior, social skills, and self-esteem when compared to SWD learning in solo-taught special education classrooms (Forbes & Billet, 2012, p. 61).

To create inclusive classrooms where SWD work alongside students without disabilities (SWOD), educators must modify the way they teach without reducing student workload. General educators (GEs) and special educators (SEs) should collaborate to share instruction and assessment equally and be able to use diverse strategies to provide interventions that benefit all students within this inclusive classroom (Battaglia & Brooks, 2019, pp. 80-81).

Complicating this move towards more inclusive practices is a lack of training and experience within the co-teaching team. Many science teachers lack the training or experience necessary to differentiate instruction for SWD and many SEs lack training or experience with science content (Linz et al., 2011, p. 1).

Pre-service Teacher Perceptions of Co-teaching

Research shows that both GEs and SEs lack efficacy with regards to co-teaching science. A study in 2010 found that pre-service SEs were concerned about their lack of content knowledge, while their counterparts, GEs, were concerned about teaching SWD. Some preservice teachers noted that even though they were concerned about their abilities, they gained confidence as they learned more about co-teaching within their teacher training program (Arndt & Liles, p. 19). Regarding effective partnerships, the researchers also noted that GEs and SEs needed to see each other as mutually supportive partners within the science classroom, a paradigm that cannot be realized without both parties being able to teach the content and the diverse range of students they share (Arndt & Liles, 2010, p. 21).

Gaps in Training

As co-teaching is a modern approach to science education, much is still developing regarding training needed. Individuals entering teacher training programs are best poised to gain knowledge and experience before entering the classroom. Teachers already in-service need opportunities to expand their knowledge banks through meaningful professional development classes.

Pre-service Teacher Training Programs

The biggest opportunity for pre-service training programs lies in the cross training of GEs and SEs. General educators need strategies for differentiating instruction, while special educators should have some knowledge of the content area they will be teaching in.

Science teachers' pre-service training lacks explicit instruction for differentiation and does not prepare them to teach a wide range of students. Many science teachers report that they were required to take one course regarding special education and that the coursework only covered the types of disabilities, not the strategies needed to instruct the students with those disabilities (Arndt & Liles, 2010, p. 20; Dieker & Rodriguez, 2013, p. 47).

Special education teachers similarly reported a gap in their training. As a result, these teachers had low efficacy regarding their ability to teach the science content (Preston-Smith et al., 2020, p. 30). The lack of science expertise prevents the SE from developing content specific strategies for vocabulary, or in facilitating higher order data analysis by students. Developing these scaffolds is critical for students with disabilities that are trying to access advanced science classes (Dieker & Rodriguez, 2013, p. 47).

Not only should GE and SE teachers be cross trained, but they should also be given plenty of opportunities to practice collaborating and differentiating instruction within their pre-

service teacher training programs. (Arndt & Liles, 2010, pp. 20-23; Dieker & Rodriguez, 2013, p. 47).

In-service Professional Development

Dusty and Dinnesen (2012) closely monitored an in-service co-teaching team. What they found was that these teachers lacked a diversity of co-teaching strategies. Prior to a three-day professional development course, the team typically operated in a "one teach-one observe" model. This did not follow industry best practices for differentiated instruction. In this capacity, the science teacher took on the role of educator, while the SE teacher monitored the room. When students witness this dynamic in the classroom, it affects how they view the SE.

Researchers point out that students are keenly aware of the lack of parity between many science teachers and SEs. They know that one teacher should not be doing all the work while the other is only helping. To avoid this, both educators need to be equally prepared to teach the lesson (Preston-Smith, 2020, p. 30-37). Conversely, students are also able to see when a co-teaching partnership is going well. They reported that having two teachers made learning easier because everyone received help faster and was able to move on (Dieker et al., 2013, p. 21).

Targeted Training Needed

To meet the demands of a co-teaching classroom, educators should have access to quality training. Some training should be handled in teacher training programs, with continued professional development opportunities once in-service. Those teachers already practicing will benefit from the same professional development courses to adapt their pedagogy.

Pre-service Training

There is a need for teacher educators to provide more training to pre-service teachers, particularly regarding collaboration and co-teaching. This training should be offered to both SEs

and GEs (Ansari Ricci et al., 2021 pp. 527). This training should not focus on any one model and should require pre-service teachers to experience co-teaching during their student teaching assignments (Ansari Ricci et al., 2021, p. 518; Forbes & Billet, 2012, pp. 61-63; Linz et al., 2011, pp. 36-27).

Promising results were found after piloting a yearlong residency within one teacher training program. Those completing the residency reported higher efficacy regarding co-teaching and found the experience beneficial for pre-service teachers (Ansari Ricci et al., 2021, pp. 520-526).

In-service Professional Development

In-service teachers would benefit from having targeted professional development to expand their skills for differentiation, and for using a variety of co-teaching instructional strategies (Battaglia & Brooks, 2019, p. 81). This expansion of practice would benefit students with disabilities co-taught in the science classroom (Preston-Smith, 2020, pp. 30-39).

For example, one school provided all teachers with training on the art and science of co-teaching before beginning the school year, regardless of their upcoming teaching assignments. Teachers then assigned to co-teaching classrooms were better able to differentiate their approach within their classroom, and all teachers developed strategies for helping students with special needs that were taught in single teacher general education classrooms (Dieker et al., 2013).

Providing professional development opportunities for in-service teachers increases the efficacy of GEs and SEs working in co-taught science classrooms. When SEs have higher efficacy, they are more likely to have a more significant role in the classroom than merely monitoring students' progress (Dusty & Dinneson, 2012, pp. 46-47).

Dusty and Dinnesson (2012) went on to recommend that building administration should also receive the same training for co-taught classrooms. Administrators would then know what to look for in co-teaching science classrooms, and how to provide support that the co-teaching team may need to further develop their practice. Ongoing support provided by school administration that helps teachers to select proper co-teaching models, content specific strategies, and to build their co-teaching efficacy is essential to ensuring co-teaching success (Dusty & Dinneson, 2012, pp. 46-49).

Collaborative Efforts Benefit All Students

The training needed to become an effective science co-teaching team has benefits outside of co-taught classrooms as well. The co-teaching science team combines their skills and pedagogical experience to enrich the instruction of their shared students (Strogilos & King-Sears, 2019, p. 92). Through training and practice, the GE also gains efficacy in differentiating the instruction for students taught in all general education classrooms (Dieker et al., 2013, p. 20).

SEs with content knowledge are better prepared to provide remediation for SWD, and to be able to suggest enrichment for higher-performing students without disabilities (Battaglia & Brooks, 2019, p. 81). Having SEs with expertise in science is imperative if SWD are going to have access to advanced science courses, and later, advanced science careers (Dieker & Rodriguez, 2013).

Conclusion

As schools are shifting towards including more co-teaching classrooms in science content areas to meet the needs of SWD, pedagogy must change as well. To meet this demand teacher training programs and professional development offerings must be evaluated to determine where gaps in training exist, what training pre-service and in-service teachers have already received,

and what changes need to be made to assist teachers in gaining the skills needed to meet the needs of their dynamic classrooms.

Methodology

This research examined the need for pre-service teacher training and in-service teacher professional development that prepares general educators (GEs) and special educators (SEs) to co-teach in science classrooms. It has been recognized that many science teachers lack training or experience in teaching students with disabilities (SWD) and that many SEs lack science content knowledge (Linz et al., 2011, p.1). This survey examined whether this gap in training exists locally or can be seen on a larger scale.

A survey design was chosen to gather information about teacher preparedness and efficacy in teaching various students. Qualitative and quantitative methods were used to analyze the results. Additionally, this survey allowed the researcher to compare responses across several states to determine how widespread this problem is within the science teaching community (Creswell & Guetterman, 2019, p. 408).

Participants and Setting

Participants in this study were middle school and high school teachers that have taught, or currently teach, science in co-taught classrooms. To reach a broader population of participants fitting this description, this survey was administered online through Qualtrix so that teachers from school districts around the country could participate. Participants were encouraged to share the survey with other general and special education teachers meeting the study criteria.

Social media was leveraged to broaden the pool of participants using Facebook and X (Twitter). Invitations were posted in Facebook groups dedicated to science teaching, and on the

researcher's personal social media pages. This online reach allowed for a broad geographical range of responses (Creswell & Guetterman, 2019, p. 390).

No personally identifying information, such as participant name or school district, was gathered to protect the anonymity of participants and to encourage candid responses. The survey gathered information regarding grade level(s) taught, type of school district (urban, suburban, rural), state of residence, the teacher's current role as a GE or SE, and education level of the teacher to disaggregate data accordingly.

In the social media posts, participants were directed to a web survey hyperlink. The first page provided a cover letter (Appendix A) explaining the survey's purpose and scope. After reading the given information and being provided with an opportunity to ask questions through the email addresses provided, respondents were able to participate by clicking the "I consent to participate in this survey" hyperlink. Participants were told they could stop the survey at any point and not have their data collected.

The survey (Appendix B) used a mix of closed-ended and open-ended questions. Teacher perceptions of their abilities to co-teach science and preparation for co-teaching science were measured on a Likert scale using a series of closed-ended questions. Pre-set answers for these questions allowed for an efficient comparison of responses (Creswell & Guetterman, 2019, p. 395). All survey questions were designed and developed by the researcher from the literature review completed for this study.

An open-ended question was used for participants' locations to compare data across local, regional, and national trends. Open-ended questions were also asked to determine what types of training participants believed would benefit current and future teachers. The survey took approximately 20 minutes for participants to complete.

Data Collection

This cross-sectional survey was conducted online, using Qualtrix. The survey questions were researcher developed. Demographic questions were asked in multiple choice or open response format and teacher perception was measured using a scale of agreement (strongly agree to strongly disagree) (Creswell & Guetterman, 2019, p. 402).

Using an online form allowed for rapid deployment and response collection within the survey window (Creswell & Guetterman, 2019, p. 392). The online form generated a spreadsheet of responses for quick disaggregation of data. The raw data from Qualtrix, and the spreadsheet were only accessible by password that only the researcher had access to, with no identifying information recorded. Data will be destroyed following the satisfactory completion of this research study.

Data Analysis

After the survey window of two weeks, the researcher analyzed the results to determine trends, grouping responses appropriately. A score of 1-5 was used to quantify Likert scale responses. Strongly disagree (1) to strongly agree (5) were used for teachers to respond to questions. The responses were averaged to determine teacher efficacy, preparedness, and perceptions of adequacy of teacher training initiatives.

Comparisons were drawn between teachers with few years of service and those with many years, and traditionally trained teachers versus teachers receiving training through alternate paths to teaching. Implications for changes to current training were made using teachers' perceptions of their ability to effectively co-teach in a science classroom, and teacher perceptions of current training programs.

Findings and Results

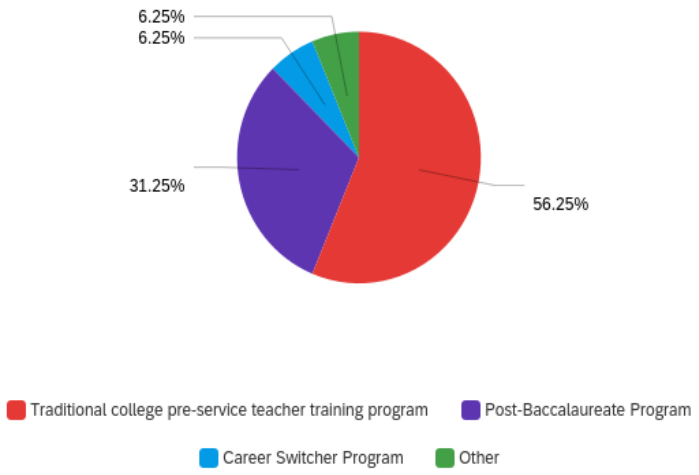
In analyzing the results, this researcher made connections between years of service, types of teacher training programs, and teacher efficacy in teaching students with disabilities in secondary science classrooms.

Demographics

Sixteen responses were received from 11 states. Five were received from the researcher's home state of Virginia, two from New Jersey, and single responses from Montana, Indiana, Arkansas, West Virginia, Mississippi, Arizona, Texas, Missouri, and Connecticut. A wide spread of years of service was observed in the responses with half of participants reporting more than 11 years of experience teaching. No participants reported less than 3 years of service.

Fifty-six percent of respondents reported being trained in traditional pre-service teacher programs, with the remaining 44% obtaining licensure through alternate avenues such as post-baccalaureate programs (31%), career switcher programs (6%), or through a combination of career switcher and post-baccalaureate (6%) (Figure 1).

Figure 1: Pre-service Teacher Training Pathway



Perceptions of Individuals' Training Programs and Opportunities

In the survey (Appendix B), respondents were asked questions regarding their experiences in their pre-service teacher training programs and in-service professional development opportunities. They were asked about coursework, and whether they felt their coursework prepared them for teaching a variety of students in their science classrooms.

Pre-Service Training Received

Teachers that obtained licensure through traditional pre-service teacher training programs more often reported being required to take a *Survey of Special Education* course or coursework with strategies for teaching students with disabilities than teachers obtaining licensure through alternate pathways. Nearly 78% of traditionally trained teachers reported the *Survey of Special Education* course as being a requirement of their program when compared to 40% of teachers that sought licensure through alternate means (Table 1).

Table 1: Percentage of teachers that completed a *Survey of Special Education* course within their pre-service teacher training program.

	Required	Elective	Not Applicable
Traditional Teacher Training Program	77.8%	11.1%	11.1%
Post-Baccalaureate Program	40.0%	20.0%	40.0%
Career Switcher Program	0.0%	0.0%	100.0%

Additionally, teachers in traditional programs reported their coursework required them to learn strategies for teaching students with disabilities more often than those participating in a post-baccalaureate program. Teachers trained through career switcher programs reported not having any coursework designed to teach them, or give them experiences with, strategies for teaching students with disabilities (Table 2).

Table 2: Percentage of teachers that completed coursework providing strategies for teaching students with disabilities within their pre-service teacher training program.

	Required	Elective	Not Applicable
Traditional Teacher Training Program	66.7%	22.2%	11.1%
Post-Baccalaureate Program	40.0%	20.0%	40.0%
Career Switcher Program	0.0%	0.0%	100.0%

Conversely, many teachers reported not having any pre-service coursework related to co-teaching in content specific classrooms (Table 3).

Table 3: Percentage of teachers that completed coursework that taught or provided experience with co-teaching in content specific classrooms within their pre-service teacher training program.

	Required	Elective	Not Applicable
Traditional Teacher Training Program	22.2%	11.1%	66.7%
Post-Baccalaureate Program	25.0%	0.0%	75.0%
Career Switcher Program	0.0%	100.0%	0.0%

Participants were asked to use a Likert Scale of "Strongly Disagree" (1) to "Strongly Agree" (5) to evaluate four statements regarding their beliefs on how well their pre-service teacher training program prepared them to teach science in secondary classrooms (Table 4). Participants slightly agreed that their pre-service teacher training program adequately prepared them to teach general education students (3.63) and to differentiate instruction within the science classroom (3.44). They slightly disagreed with statements that their program adequately prepared them to instruct students with disabilities (2.69), or to co-teach science with a partner teacher (2.44).

Table 4: Teacher perceptions of pre-service teacher training programs

Field	Minimum	Maximum	Mean	Std Deviation	Variance
My pre-service teacher training program adequately prepared me to teach general education students in science classes.	2.00	5.00	3.63	0.99	0.98
My pre-service teacher training program adequately prepared me to teach students with disabilities in science classes.	1.00	4.00	2.69	0.98	0.96
My pre-service teacher training program adequately prepared me to differentiate instruction in science classes.	1.00	5.00	3.44	1.17	1.37
My pre-service teacher training program adequately prepared me to co-teach science classes with a partner teacher.	1.00	5.00	2.44	1.12	1.25

In-Service Professional Development Opportunities

Few participants reported having required in-service professional development courses or taking elective courses for additional training in teaching students with disabilities in science classrooms. Seventy-five percent of respondents report not having any coursework related to the identification of disabilities or legal requirements for teaching students with those disabilities (Table 5). Over 78% of teachers report having required or elective in-service professional development related to strategies for teaching students with disabilities. Only 62% of teachers reported taking in-service professional development courses that prepared them to teach in a co-taught content specific classroom.

Table 5: Percentage of teachers that utilized in-service professional development opportunities for training regarding teaching students with disabilities.

	Required	Elective	Not Applicable
Survey of Special Education course: Laws regarding students with disabilities, and identification of disabilities only.	18.8%	6.3%	75.0%
Course(s) that taught you, or gave you experience with, strategies to use when teaching students with disabilities.	25.0%	43.8%	31.3%
Course(s) that taught you, or gave you experience with, strategies for co-teaching in content specific classrooms.	25.0	37.5%	37.5%

Participants were asked to use a Likert Scale of "Strongly Disagree" (1) to "Strongly Agree" (5) to evaluate four statements regarding their beliefs on how well their in-service professional development opportunities prepared them to teach science in secondary classrooms (Table 6). Participants responded neutrally (2.94-3.06) to statements regarding preparation for teaching general education students and students with disabilities, or strategies for differentiation within science classrooms. Respondents did not agree (2.44) that in-service professional development opportunities adequately prepared them to co-teach science classes with a partner teacher.

Table 6: Teacher perceptions of in-service professional development opportunities

Field	Minimum	Maximum	Mean	Std Deviation	Variance
In-service professional development opportunties have adequately prepared me to teach science classes to general education students.	1.00	5.00	3.06	1.25	1.56
In-service professional development opportunities have adequately prepared me to teach students with disabilities in science classes.	1.00	5.00	2.94	1.30	1.68
In-service professional development opportunities have adequately prepared me to differentiate instruction in science classes.	1.00	5.00	3.06	1.20	1.43
In-service professional development opportunities have adequately prepared me to co-teach science classes with a partner teacher.	1.00	5.00	2.44	1.37	1.87

Perceptions of Teacher Training Programs and Professional Development Opportunities

Participants disagreed (2.31) that pre-service teacher training programs provide adequate opportunities for general educators to learn strategies for teaching students with disabilities (Table 7). They also disagreed (2.19) that special educators are given adequate opportunities for gaining science knowledge or science specific strategies for teaching students with disabilities in a secondary science classroom. Additionally, they also disagreed (1.94) with there being adequate opportunities for both teachers to gain knowledge of, or experience in co-teaching

secondary science classes.

Table 7: Educator perceptions of pre-service teacher preparation programs.

Field	Minimum	Maximum	Mean	Std Deviation	Variance
Pre-service teacher training programs provide adequate opportunities for general educators to learn strategies for teaching students with disabilities in the secondary science classroom.	1.00	5.00	2.31	1.26	1.59
Pre-service teacher training programs provide adequate opportunities for special educators to gain science specific knowledge and science specific strategies for teaching students with disabilities in the secondary science classroom.	1.00	5.00	2.19	1.38	1.90
Pre-service teacher training programs provide adequate opportunities for both general educators and special educators to gain knowledge and/or experience in co-teaching secondary science classrooms.	1.00	4.00	1.94	1.03	1.06

Agreement regarding opportunities provided during in-service professional development were slightly higher (Table 8). Participants only slightly disagreed that general educators were given adequate opportunities for learning strategies to instruct students with disabilities (2.75), that special educators were given opportunities for learning science content or science specific strategies (2.44), or that either teacher was given adequate opportunities for training to co-teach

in a secondary science classroom (2.63).

Table 8: Educator perceptions regarding in-service professional development opportunities.

Field	Minimum	Maximum	Mean	Std Deviation	Variance
In-service professional development courses provide adequate opportunities for general educators to learn strategies for teaching students with disabilities in the secondary science classroom.	1.00	4.00	2.75	1.15	1.31
In-service professional development courses provide adequate opportunities for special educators to gain science specific knowledge and science specific strategies for teaching students with disabilities in the secondary science classroom.	1.00	4.00	2.44	1.12	1.25
In-service professional development courses provide adequate opportunities for both general educators and special educators to gain knowledge and/or experience in co-teaching secondary science classrooms.	1.00	4.00	2.63	1.22	1.48

Teacher Efficacy

This study asked participants to respond with a scale of their preparedness and comfort in teaching students with or without disabilities, in differentiating instruction, and in co-teaching science with a partner teacher. New teachers (<5 years of service) and veteran teachers (>5 years of service) were compared to determine trends in preparedness and comfort.

New Teacher Preparedness and Comfort

Participants were asked to use a Likert Scale of “Strongly Disagree” (1) to “Strongly Agree” (5) to evaluate four statements regarding their preparedness for teaching in secondary science classrooms (Table 9). New teachers felt they were prepared to teach general education students (4.33), but felt less prepared to teach students with disabilities (3.83), to differentiate instruction (3.67), or to co-teach science with a partner teacher (3.33).

Table 9: New Teacher Preparedness

Field	Minimum	Maximum	Mean	Std Deviation	Variance
I feel prepared to co-teach general education students in science classes.	4.00	5.00	4.33	0.47	0.22
I feel prepared to co-teach students with disabilities in science classes.	2.00	5.00	3.83	0.90	0.81
I feel prepared to differentiate instruction in science classes.	3.00	5.00	3.67	0.75	0.56
I feel prepared to co-teach science with a partner teacher.	1.00	5.00	3.33	1.49	2.22

New teachers reported being comfortable with teaching general education students (4.33), and in differentiating instruction (4.00) with slightly less comfort in teaching students with disabilities (3.83) or in co-teaching science (3.83) (Table 10).

Table 10: New teacher comfort.

Field	Minimum	Maximum	Mean	Std Deviation	Variance
I feel comfortable co-teaching science to general education students.	4.00	5.00	4.33	0.47	0.22
I feel comfortable co-teaching science to students with disabilities.	3.00	5.00	3.83	0.69	0.47
I feel comfortable differentiating instruction in science classes.	3.00	5.00	4.00	0.58	0.33
I feel comfortable co-teaching science classes with a partner teacher.	2.00	5.00	3.83	1.07	1.14

Veteran Teacher Preparedness and Comfort

When probed, veteran teachers reported being slightly comfortable teaching general education students (4.20), teaching students with disabilities (4.20), differentiating instruction (4.40), and in co-teaching with a partner teacher (4.10) (Table 11).

Table 11: Veteran teacher preparedness

Field	Minimum	Maximum	Mean	Std Deviation	Variance
I feel prepared to co-teach general education students in science classes.	2.00	5.00	4.20	0.98	0.96
I feel prepared to co-teach students with disabilities in science classes.	2.00	5.00	4.20	0.98	0.96
I feel prepared to differentiate instruction in science classes.	3.00	5.00	4.40	0.80	0.64
I feel prepared to co-teach science with a partner teacher.	2.00	5.00	4.10	0.94	0.89

Veteran teachers reported being comfortable with teaching general education students (4.30) with slightly less comfort teaching students with disabilities. They reported strong comfort in differentiating instruction, with slight comfort in co-teaching science with a partner teacher (Table 12).

Table 12: Veteran teacher comfort

Field	Minimum	Maximum	Mean	Std Deviation	Variance
I feel comfortable co-teaching science to general education students.	1.00	5.00	4.30	1.19	1.41
I feel comfortable co-teaching science to students with disabilities.	1.00	5.00	3.90	1.22	1.49
I feel comfortable differentiating instruction in science classes.	3.00	5.00	4.60	0.66	0.44
I feel comfortable co-teaching science classes with a partner teacher.	1.00	5.00	4.10	1.22	1.49

Discussion

There is no debate that experience is the best teacher, and that educators will gain far more knowledge within the walls of their classroom than they will on a college campus or in a professional development session. What is under examination is whether current teacher training programs do enough to give teachers a solid foundation for teaching students with disabilities, and whether professional development opportunities give practicing educators proper targeted support in which to build their pedagogy. No licensed teacher should have to enter a classroom feeling ill-prepared to teach all the students in front of them.

This study found that novice secondary science teachers feel adequately prepared to teach general education students in science classrooms. Efficacy fell however, when teachers were asked about their preparedness to teach students with disabilities or to differentiate their instruction. Alarmingly, novice teachers reported feeling less prepared to co-teach in science classrooms than they did to teach students with disabilities. Veteran teachers reported feeling equally prepared to teach general education students, students with disabilities, to differentiate, and to co-teach science classes with a partner teacher. This difference in perception is likely due to experiences gained through years of service.

Apprehension in novice teachers may be due in part to a lack of training in collaboration. Classroom teachers need to collaborate with colleagues, parents, and community members to meet the range of needs within their classroom, but novice teachers may not have the training or skills needed to do so (Strieker et al. 2013, p. 159). Co-teaching is quickly gaining traction as a viable means of fostering collaboration between general education teachers and special education teachers to meet the demands of NCLB and IDEA. Strieker et al. (2013) suggest that this increase in the use of co-teaching models does not automatically lead to increased understanding in how to effectively execute the practice of co-teaching. Rather, they suggest, teacher education programs must do more to prepare pre-service teachers for collaborative teaching assignments (Strieker et al., 2013, pp. 160-161).

Perceptions of Current Teacher Training

Respondents felt that current pre-service teacher training programs do not adequately prepare teachers to teach science in co-taught classrooms, or to a growing population of students with disabilities. Results from the survey showed traditional teacher training programs, post

baccalaureate programs, and career switcher programs varied in their delivery of coursework needed to make effective co-teaching practices a reality.

Traditional teacher training programs offered the highest number of required courses for teaching students with disabilities, with career switchers reporting not having had any training for teaching students with disabilities. In all pre-service program types, not all participants were required to take courses, or have experiences in co-teaching in content specific classrooms. As a result, the general belief is that pre-service training programs do not adequately prepare teachers for co-teaching in science classrooms, instead believing collaborative skills to be intuitive or developed over time (Strieker et al., 2013). While these skills can develop over time, as shown in veteran teacher comfort and preparedness in co-teaching, they are also skills that can be systematically taught within pre-service teacher training programs.

In-service professional development opportunities also do little to prepare teachers for co-teaching. Nearly a third of educators have never attended a professional development session teaching skills for instructing students with disabilities or strategies for co-teaching in content specific classrooms. Educators felt that in-service professional development opportunities did not adequately prepare them for co-teaching in science content specific classrooms, a sentiment that was echoed in Chitiyo and Brinda's (2018) study. In that study, educators indicated feeling underprepared and needing additional training regarding implementation of co-teaching practices.

Implications for Change

The following sections outline suggested changes to pre-service teacher training programs and in-service professional development opportunities to better prepare teachers for co-teaching in science classrooms.

Pre-service Teacher Training Programs

For secondary science teachers to confidently engage in co-teaching practices, adjustments to pre-service teaching training programs are necessary. Systematic and deliberate teaching of collaborative practices should be woven into current training programs. Pre-service teachers should have multiple opportunities to study, reflect, and apply co-teaching practices throughout their coursework and student teaching (Streiker et al., 2013).

One idea, proposed by Chitiyo and Brinda (2018), is to team general education faculty with special education faculty to co-teach methods courses, giving pre-service teachers a model of effective co-teaching practices that they can carry into student teaching, and use within their future classrooms (p. 49). Faculty modeling of co-teaching can be done as part of an explicit course on co-teaching methods, or through guest-teaching opportunities within content specific methods courses.

A second method is to incorporate a residency program where pre-service teachers are paired with mentor teachers for an entire school year. Mentor teachers work with their residents to incorporate theoretical knowledge with classroom experience. Within the program, residents can study, incorporate, and reflect on their co-teaching practices under the supervision of an experienced teacher. Having this experience boosts their efficacy in teaching students with disabilities, differentiating instruction, and co-teaching in content specific classrooms (Ricci et al., 2019; Ricci et al., 2021).

In-service Professional Development Opportunities

Practicing educators need opportunities to acquire new skills through targeted professional development opportunities. All teachers, or at a minimum co-teaching teams, should receive training in co-teaching practices (Battaglia, 2019, p. 81). At one middle school, all

teachers, regardless of upcoming teaching assignments, attended a professional development on the art and science of co-teaching before the school year began (Dieker et al., 2013 p. 19). In another study, co-teaching teams that were already assigned attended professional development together, learning models and methods for co-teaching. That study suggested that administrators attend the co-teaching training alongside teachers to learn what effective co-teaching practices look like, what to look for during observations to provide accountability, and how to provide the support that their co-teaching teams needed (Dusty & Dinneson, 2013, p. 50).

Additionally, co-teaching teams should be given joint planning time to collaborate on lesson plans, analyze data, and reflect on their practices (Battaglia, 2019, p. 82; Dieker et al., 2013, p. 19; Dusty & Dinneson, 2012, p. 38). Joint planning time is critical to ensuring full implementation and continuation of co-teaching practices learned in professional developments (Dusty & Dinneson, 2012, p. 47). Co-teaching teams that meet regularly can develop a shared vision of success, are able to become more inclusive of all learners in their room, and can develop trusting relationships with each other and their students to foster the development of skills (Fluijt et al., 2016, p. 196).

Limitations

Several limiting factors could affect the knowledge gained from this study. While survey respondents participated from many different regions in the United States, only16 survey responses were recorded. With a higher response rate, this research may have found different perceptions of training programs and professional development opportunities available across the United States. Limiting the number of surveys collected was the short time frame the survey was

open and the method of delivery, e.g., social media. With more time, exposure, and membership in more networking groups, a higher response rate may have been seen.

Of the surveys completed, 15 were completed by general educators and one was completed by a special educator. Including more special educators in the response pool may have given better insight into training received by special educators. The findings about special educators' preparation are primarily from the general educators' perspectives rather than firsthand knowledge of the training programs.

Of note is the lack of very new (less than 3 years of service) teachers. Perceptions of training programs may not match what is currently offered if teacher training programs have already begun adjusting their curriculum to meet the needs of the evolving classrooms.

Conclusion

Gone are the days of exclusionary teaching practices that separate students with disabilities from their same-aged peers. Students are placed in the least restricted environment that meets their individual needs, with many students being placed in general education settings. To best support students' academic and behavioral needs, general education teachers and special education teachers are being assigned into co-teaching teams. In secondary science classrooms, these professionals work together to deliver science instruction to a diverse group of students. Lacking proper training in co-teaching models leads to stagnant teaching practices in which the general educator and special educator are not seen as equal partners in the classroom.

Teachers surveyed for this study do not feel that current training is adequate to support co-teaching in science classrooms, and as a result, have lower confidence in their abilities to instruct students with disabilities, to differentiate their science lessons, and to co-teach within a general education science classroom. Pre-service teacher training programs and in-service

teacher professional development opportunities must evolve to support co-teaching practices in science classrooms. Administrators, senior district leadership, and teacher educators should explore avenues for incorporating training in co-teaching models within their institutions.

When educators are provided with targeted training, given adequate time to plan and reflect, and supported through the development of their skills, their efficacy in co-teaching science content increases. With an increase in skills and teacher efficacy, student performance also increases, leading to access of higher-level science classes for students with disabilities.

References

Ansari Ricci, L., Persiani, K., Williams, A. D., & Ribas, Y. (2021). Preservice general educators using co-teaching models in math and science classrooms of an urban teacher residency programme: Learning inclusive practices in teacher training. *International Journal of Inclusive Education, 25*(4), 517–530. https://doi-org.umw.idm.oclc.org/10.1080/13603116.2018.1563643

Arndt, K., & Liles, J. (2010). Preservice teachers' perceptions of coteaching: A qualitative study. *Action in Teacher Education (Association of Teacher Educators), 32*(1), 15–25. https://doi-org.umw.idm.oclc.org/10.1080/01626620.2010.10463539

Battaglia, E., & Brooks, K. (2019). Strategies for co-teaching and teacher collaborations. *Science Scope, 43*(2), 80–83.

Chitiyo, J., & Brinda, W. (2018). Teacher Preparedness in the use of co-teaching in inclusive classrooms. *Support for Learning*, 33(1), 38–51. https://doi-org.umw.idm.oclc.org/10.1111/1467-9604.12190

Creswell, J. W., & Guetterman, T. C. (2021). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (6th ed.). Pearson.

Dieker, L., Finnegan, L., Grillo, K., & Garland, D. (2013). Special education in the science classroom. *Science Scope, 37*(4), 18–22.

Dieker, L. A., & Rodriguez, J. A. (2013). Enhancing secondary cotaught science and mathematics classrooms through collaboration. *Intervention in School & Clinic, 49*(1), 46–53. https://doi-org.umw.idm.oclc.org/10.1177/1053451213480028

Dusty, C. E., & Schneider Dinnesen, M. (2012). Co-teaching in inclusive classrooms using structured collaborative planning. *Kentucky Journal of Excellence in College Teaching & Learning*, *10*, 36–52.

Fluijt, D., Bakker, C., & Struyf, E. (2016). Team-reflection: the missing link in co-teaching teams. *European Journal of Special Needs Education*, 31(2), 187–201. https://doi-org.umw.idm.oclc.org/10.1080/08856257.2015.1125690

Forbes, L., & Billet, S. (2012). Successful co-teaching in the science classroom. *Science Scope, 36*(1), 61–64.

Francisco, M. P. B., Hartman, M., & Wang, Y. (2020). *Inclusion and special education. Education Sciences, 10*(9), 238. https://doi-org.umw.idm.oclc.org/10.3390/educsci10090238

Hallahan, D. P., Kauffman, J. M., & Pullen, P. C. (2019). *Exceptional learners: An introduction to special education*. Pearson.

Johnson, N. H., & Brumback, L. (2013). Co-teaching in the science classroom: The one teach/one assist model. *Science Scope*, *36*(6), 6–9

Linz, E., Heater, M. J., & Howard, L. A. (2011). *Team teaching science: Success for all learners*. National Science Teachers Association Press.

Preston-Smith, S., King-Sears, M. E., Evmenova, A. S., & Baker, P. H. (2020). What do high school students think about co-teaching in science classrooms? *Learning Disabilities: A Multidisciplinary Journal, 25*(1), 29–43. https://doi-org.umw.idm.oclc.org/10.18666/LDMJ-2020-V25-I1-10107

Ricci, L. A., Persiani, K., & Williams, A. D. (2019). From “training wheels for teaching” to “cooking in your mother-in-law’s kitchen”: Highlights and challenges of co-teaching

among math, science, and special education teacher candidates and mentors in an urban teacher residency program. *International Journal of Whole Schooling*, *15*(2), 24–52.

Strieker, T., Gillis, B., & Guichun Zong. (2013). Improving pre-service middle school teachers' confidence, competence, and commitment to co-teaching in inclusive classrooms. *Teacher Education Quarterly*, *40*(4), 159–180.

Strogilos, V., & King, S. M. E. (2019). Co-teaching is extra help and fun: Perspectives on co-teaching from middle school students and co-teachers. *Journal of Research in Special Educational Needs*, *19*(2), 92–102. https://doi-org.umw.idm.oclc.org/10.1111/1471-3802.12427

Appendix A

ADULT RESEARCH PARTICIPANT INFORMED CONSENT FORM

Brief Description

The purpose of this research is to investigate teachers' perceptions of their preparation for co-teaching in secondary science content areas. Individuals who volunteer to participate in this study will be general education (GE) teachers or special education (SE) teachers who currently or previously co-taught in a secondary science class.

Participants will complete a survey that collects data regarding pre-service and in-service preparations for co-teaching students with disabilities in science content areas. Depending on your responses, the time to complete the survey will take 10-15 minutes, which may be uncomfortable for some participants. To reduce discomfort, the survey has been formatted to only ask questions that pertain to your personal experiences. There are no direct benefits or rewards for participants in this study. **Please read the remainder of this form before deciding if you want to volunteer to be in this research study.**

My name is Sabrina Christensen, I am a graduate student at the University of Mary Washington in Fredericksburg, VA, and I am seeking your consent to participate in this research study. Involvement in the study is voluntary, so you may choose to participate or not. The information below explains the study in detail. Before volunteering, please ask any questions about the research; I will explain anything in greater detail.

Details of Participant Involvement

I am interested in learning more about teachers' efficacy in and preparation for co-teaching students with disabilities in science content areas. If you agree to participate, you will be asked to complete a survey with questions regarding your training experiences, preparedness, and comfort in co-teaching students with disabilities in science content areas. Additional questions will be used to compare data amongst different states or types of school systems (urban, suburban, rural).

Privacy and Confidentiality

All information about participants will be kept anonymous. This means that your name will not appear in any data collected or in any reports of this research, and neither I nor anyone else will be able to associate you with your data. When the research is complete, I will destroy all participant data.

Risks and Benefits of Participation

The risks to you for participating in this study may include discomfort with the survey's length. These risks will be minimized by formatting the survey to only ask you questions regarding the role(s) you have or are currently playing in science content areas. If you should experience any difficulties during the study, please tell me immediately so that I may take appropriate action. The benefit of this research is that it may contribute to better general understanding of teacher preparatory programs regarding teaching students with disabilities in science content areas. There are no direct benefits to you as a participant.

Participant Rights

You have the right to **ask any questions you have** before, during or after participation, and I encourage you to do so. If you do not want to be in this study, there will be no penalties or loss of benefits that you are entitled to. You can withdraw from the survey at any time. If you volunteer to be in this study and later change your mind, you have the right to withdraw. You may withdraw by exiting the survey before completion and your data will not be collected. As a voluntary participant in this research, you have the right to refuse to perform any activities and answer any questions that I ask of you. This research has been approved by the University of Mary Washington Institutional Review Board, a committee responsible for ensuring that the safety and rights of research participants are protected. For information about your rights as a research participant, contact the IRB chair, Dr. Rosalyn Cooperman (rcooperm@umw.edu).

Contact Information

For more information about this research before, during or after your participation, please contact me Sabrina Christensen (schrist3@mail.umw.edu) or my university supervisor, Dr. Teresa Coffman (tcoffman@umw.edu). To report any unanticipated problems relating to the research that you experience during or following your participation, contact my university supervisor, Dr. Teresa Coffman (tcoffman@umw.edu).

Before continuing, please ask me any questions you have about participation in this study.
By clicking "I consent to participating in this survey" you acknowledge that you have read all information on this form, and all your questions and concerns about the research described above have been addressed. You are choosing, voluntarily, to participate in the research project. Additionally, you certify that you are at least 18 years of age.

Appendix B

Teacher Survey

Demographic Questions

1. Do you co-teach, or have you co-taught in a secondary science classroom?

   Co-teaching for this study is defined as a general education science teacher and special education teacher delivering substantive instruction to a diverse, or blended, group of students in a single physical space. Secondary classrooms for this study are classrooms that exclusively teach 6^{th}-12^{th} grade students.

   ____ Yes ____ No

2. What science content areas are you currently co-teaching or have co-taught previously in the secondary classroom? Please indicate whether you were the general educator or special educator. Please check all situations that apply. (Matrix Question)

	General Educator (GE)	Special Educator (SE)	I have not co-taught as the GE or SE in this content area.
General Science			
Life Science			
Physical Science			
Environmental Science			
Biology			
Earth Science			
Chemistry			
Physics			
Other			

Note: If participants answer "No" to Question 1 or select "I have not co-taught as the GE or SE in this content area" for all contents in Question 2, a prompt thanking them for participation and dismissing them from survey will be triggered. All other participants will continue the survey.

3. Which grade level(s) are you currently co-teaching, or have previously co-taught in secondary science classrooms? (Matrix Question)

	Currently Co-teaching	Previously Co-taught
Middle School (6-8)		
High School (9-12)		

4. In what state or territory is your most recent secondary science co-teaching assignment? (Open Response)

5. How would you categorize the area your school is in?
    a. Urban
    b. Suburban
    c. Rural

6. How many years have you taught, including the current school year?
    a. Less than 2 years
    b. 3-5 years
    c. 6-10 years
    d. 11-20 years
    e. 21 or more years

Teacher Training

7. How did you receive your pre-service teacher training? Select all that apply.

    a. Traditional college pre-service teacher training program (4- or 5-year program resulting in a bachelor's or master's degree)
    b. Post-Baccalaureate Program (Held a Bachelors in a non-teaching degree field, then pursued teacher certificate or master's degree).
    c. Career Switcher program.
    d. Other: _____

8. What **pre-service teacher training** courses have you taken regarding teaching students with disabilities? (Matrix Question)

Pre-service courses refer to any courses taken as part of a traditional teacher training program, post-baccalaureate program, or career switcher program that leads to teacher licensure.

	Requirement	Elective	Not Applicable
Survey of Special Education course: laws regarding students with disabilities, and identification of disabilities only.			

Course(s) that taught you, or gave you experience with, strategies to use when teaching students with disabilities.			
Course(s) that taught you, or gave you experience with, strategies for co-teaching in content specific classrooms.			

9. What **in-service professional development** courses have you taken regarding teaching students with disabilities? (Matrix Question)

In-service professional development courses refer to any classes, courses, or trainings taken after initial licensure has been obtained that are used for additional certification, towards renewal of a teaching license, or for general knowledge.

	Requirement	Elective	Not Applicable
Survey of Special Education course: laws regarding students with disabilities, and identification of disabilities only.			
Course(s) that taught you, or gave you experience with, strategies to use when teaching students with disabilities.			
Course(s) that taught you, or gave you experience with, strategies for co-teaching in content specific classrooms.			

Teacher Perceptions

10. **Pre-service Teacher Training Program** (Matrix Question)
    a. Please respond to the following statements using the scale provided.

Pre-service teacher training program refers to a traditional teacher training program, post-baccalaureate program, or career switcher program that leads to teacher licensure.

`	Agree	Somewhat Agree	Neither agree nor disagree	Somewhat Disagree	Disagree
My pre-service teacher training program adequately prepared me to teach general education students in science classes.					

My pre-service teacher training program adequately prepared me to teach students with disabilities in science classes.					
My pre-service teacher training program adequately prepared me to differentiate instruction in science classes.					
My pre-service teacher training program adequately prepared me to co-teach science classes with a partner teacher.					

11. Explain (optional): Is there any additional information you would like to provide about your **pre-service teacher training program**? (Open Response)

12. **In-service Professional Development** Opportunities (Matrix Question)

    a. Please respond to the following statements using the scale provided.

    In-service professional development opportunities refer to any classes, courses, or trainings taken after initial licensure has been obtained that are used for additional certification, towards renewal of a teaching license, or for general knowledge

	Agree	Somewhat Agree	Neither agree nor disagree	Somewhat Disagree	Disagree
In-service professional development opportunities have adequately prepared me to teach science classes to general education students.					
In-service professional development opportunities have adequately prepared me to teach students with disabilities in science classes.					
In-service professional development opportunities have adequately prepared me to differentiate instruction in science classes.					
In-service professional development opportunities have adequately					

prepared me to co-teach science classes with a partner teacher.					

13. Explain (optional): Is there any additional information you would like to provide about your **in-service professional development opportunities**? (Open Response)

14. Teacher Preparedness (Matrix Question)

    b. Please respond to the following statements using the scale provided.

	Agree	Somewhat Agree	Neither agree nor disagree	Somewhat Disagree	Disagree
I feel prepared to co-teach general education students in science classes.					
I feel prepared to co-teach students with disabilities in science classes.					
I feel prepared to differentiate instruction in science classes.					
I feel prepared to co-teach science with a partner teacher.					

15. Teacher Preparedness (Matrix Question)

    a. Please respond to the following statements using the scale provided.

	Agree	Somewhat Agree	Neither agree nor disagree	Somewhat Disagree	Disagree
I feel comfortable co-teaching science to general education students.					
I feel comfortable co-teaching science to students with disabilities.					
I feel comfortable differentiating instruction in science classes.					

I feel comfortable co-teaching science classes with a partner teacher.					

16. Beliefs regarding pre-service teacher training programs (Matrix Question)

    a. Please respond to the following statements using the scale provided.

	Agree	Somewhat Agree	Neither agree nor disagree	Somewhat Disagree	Disagree
Pre-service teacher training programs provide adequate opportunities for *general educators* to learn strategies for teaching students with disabilities in the secondary science classroom.					
Pre-service teacher training programs provide adequate opportunities for *special educators* to gain science specific knowledge and science specific strategies for teaching students with disabilities in the secondary science classroom.					
Pre-service teacher training programs provide adequate opportunities for *both* general educators and special educators to gain knowledge and/or experience in co-teaching secondary science classrooms.					

17. Beliefs regarding in-service professional development opportunities (Matrix Question)

    a. Please respond to the following statements using the scale provided.

	Agree	Somewhat Agree	Neither agree nor disagree	Somewhat Disagree	Disagree
In-service professional development courses provide adequate opportunities for *general*					

educators to learn strategies for teaching students with disabilities in the secondary science classroom.					
In-service professional development courses provide adequate opportunities for *special educators* to gain science specific knowledge and science specific strategies for teaching students with disabilities in the secondary science classroom.					
In-service professional development courses provide adequate opportunities for *both* general educators and special educators to gain knowledge and/or experience in co-teaching secondary science classrooms.					

Open-ended responses

18. What specific courses, topic areas, or experiences were most beneficial in your **pre-service training programs** to prepare you for co-teaching students in secondary science classrooms?

19. What specific courses, topic areas or experiences would you like to see added to **pre-service training programs** to better prepare general education and/or special education teachers for co-teaching students in secondary science classrooms?

20. What **in-service professional development opportunities** were most beneficial in preparing you for co-teaching students in secondary science classrooms?

21. What specific courses, topic areas or experiences would you like to see added to **in-service professional development opportunities** to prepare general education and/or special education teachers for co-teaching students in secondary science classrooms?