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Recognition of Effective Co-Teaching Practices by Interdisciplinary Pre-Service Candidates

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Abstract: This study investigates the degree to which pre-service interdisciplinary groups of undergraduate education candidates recognize co-teaching skills and behaviors in practice. With the increasing emphasis on collaborative teaching models in contemporary educational settings, understanding how future educators perceive and identify effective co-teaching practices is crucial for enhancing educational preparation programs (EPPs). Using a mixed-methods approach, this study analyzed consensus ratings from an interdisciplinary assignment that asked candidates to work collaboratively while identifying best practices in co-teaching across example and non-example videos. Both quantitative and qualitative data were collected using student ratings and videos of group discussion for consensus scoring. Quantitative data were collected using consensus ratings for each indicator on the observation checklist. Qualitative data derived from video transcripts of the consensus rating sessions illuminated the process each group used and reasons each group provided for consensus ratings. The findings reveal varying degrees of recognition and understanding of co-teaching skills, highlighting both strengths and areas for improvement in the candidates' ability to identify and apply these practices. This study provides valuable insights into the preparedness of pre-service educators for collaborative teaching environments and offers recommendations for integrating co-teaching competencies more effectively into EPPs.

Keywords: co-teaching; interdisciplinary; collaboration; pre-service candidates; mixed-methods

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1. Introduction

Collaboration is a critical skill that is applied across a wide range of professions. As many professional environments become more interconnected and often interdisciplinary, intended outcomes can be significantly impacted by an individual's ability to effectively work with others. For example, medical professionals collaborate to provide comprehensive care for patients; business professionals often engage in collaboration to complete projects, coordinate tasks, and track progress; and engineers work together with various specializations (e.g., electrical, mechanical, civil) to integrate both design and safety features when developing projects. Like these professions, collaboration among educational professionals is vital and a common practice that is applied with the intent of improving student outcomes [1]. In education, teachers and other content-area specialists (e.g., literacy specialist, multilingual teachers, occupational therapists, speech-language therapists, school counselor) often engage in collaboration through various methods and practices, each contributing to a more effective and supportive educational environment. This collaboration may occur in numerous ways including: professional learning communities or communities of practice where educators meet regularly to share insights, examine data, and discuss teaching strategies; mentorship and peer coaching where an experienced educator works together with a less experienced colleague with the goal of improving instructional practices; and in attendance at workshops or conferences where educators are focused on enhancing their practice, learning new techniques, and networking with

other colleagues in their field. Within instruction, one interdisciplinary way general and special educators collaborate is by co-teaching. Historically, co-teaching has been defined as one general and one special educator working together to plan and deliver instruction [2]. However, more recently, the term co-teaching has evolved beyond the specific mentioned pairing to now include any two educators working together to plan, organize, deliver, and monitor the instructional process within the same shared space [3].

Co-teaching has origins that can be traced back to several education-related trends such as team-teaching, beginning in the 1950s [1]. This collaborative model has gained popularity in recent decades due to a range of U.S. legislative requirements (e.g., [4–6]) requiring all students to receive high-quality general education, regardless of varying factors. The appeal of co-teaching includes (a) two highly qualified educators working together outperforming that of a single teacher working alone; (b) reduction in student/teacher ratios; (c) increased instructional delivery options; (d) enhanced ability to meet the varying needs of diverse learners; and (e) variations in access to and allocation of resources. Moreover, an emerging research base illustrates that co-teaching offers several benefits for both teachers and students. Fontana [7] compared summative English and math scores of students with learning disabilities in resource versus co-taught settings. Results from this study showed that co-teaching improved student performance across both academic content areas. Similarly, Hang and Rabren [8] compared the academic performance of 58 students with disabilities in settings prior to co-teaching with co-taught settings and found that co-teaching increased students' academic performance in one or more core content areas. Additionally, Brusca-Vega et al. [9] examined achievement scores on standardized science assessments for students with and without disabilities in co-taught settings, noting observed improvements for both student populations. More recently, Bottge et al. [10] compared the math performance of 65 middle school students with disabilities in urban and rural settings, reporting that students with disabilities who received instruction in co-taught classes achieved higher scores than students with disabilities who solely participated in resource settings. Finally, Cole et al. [11] examined reading and math state test results of fourth- to eighth-grade students with disabilities in low and high inclusion settings (co-taught) and found that students who spent at least 80% of their instructional day in general education classes performed significantly higher than those who spent less time.

Beyond improving student achievement, co-teaching has also been shown to positively impact various other student and teacher outcomes. For example, Lochner et al. [12] investigated the relationship between co-teaching and student engagement in eight rural secondary schools. After observation of 5th- through 12th-grade classes across all core content areas for one full school year, results indicated that students in co-taught classrooms were more actively engaged than students who received instruction with a single teacher. Colson et al. [13] examined the impact of professional development in co-teaching on teacher self-efficacy among general and special education rural high school teachers. Findings from this study indicated that participants felt more efficacious in their ability to engage students and implement successful classroom management practices to alterable risk factors directly aligned to dropout prevention efforts. In addition, Wilson and Michaels [14] surveyed 346 students in secondary schools (127 students with disabilities and 219 students without disabilities) regarding their perceptions of co-teaching. Participants from this study reported favoring co-teaching, noting they would elect to participate in another co-taught class if given the opportunity and received better grades in those classes when compared to others. Students also commented they found the co-taught class offered more opportunities to receive additional support, multiple instructional approaches were used during the delivery of instruction, standards were higher, and they were presented with more chances to enhance their skill development.

Although research has shown strong support for co-teaching practices in terms of its positive influence on student and teacher outcomes, significant gaps exist between acquisition, fluency, maintenance, and generalization of pre-service candidates' skills related to this collaborative instructional practice. Unfortunately, pre-service candidates

are frequently faced with a lack of reliable programs and opportunities offering candidates access to actual co-taught field-based experience [15]. Current general education programs provide a limited number of courses addressing how to meet the needs of students with disabilities, usually a single course regarding teaching methods for students with disabilities. This generalized method focuses on student characteristics instead of alternative approaches to learning and hands-on field experiences [16]. Having access to limited application-based opportunities often results in pre-service candidates adopting a "grab-what-you-can" mentality, taking advantage of any opportunity that comes their way regardless of the quality. This opportunistic strategy can often lead to candidates engaging in experiences devoid of true and effective co-teaching practices, further restricting their capacity to learn collaborative techniques.

Alternatively, when programs do offer candidates field-based experiences that involve collaboration with in-service educators, these placement models often only include opportunities for candidates to engage in instructional practice with their assigned clinical educators (CEs), e.g., [17,18]. Most commonly in this previous research, the experience of a general education student teacher partnering with their CE was examined. None of the example research included special education candidates as co-teachers with the general education candidates. While experiences such as these can be beneficial and serve as exemplars or opportunities for in-service educators to model best practice for pre-service candidates, they frequently do not include direct training support in collaborative co-teaching or chances to engage in the duality of delivering instruction as co-teachers. For example, research has indicated that when these collaborative opportunities are provided, they typically rely on the One Teach/One Assist model, where the CE primarily delivers instruction and the candidate is actively walking around the classroom assisting students as needed (e.g., [19]). This is of particular interest given that this model of co-teaching has been found to be the least effective, yet it is the most commonly used [20].

Furthermore, while collaborative field-based experiences with their CEs present an opportunity for pre-service candidates to view the delivery of instruction, directly observe ways to increase student engagement, and effectively apply positive classroom management practices through a shared content specific lens, they do not offer candidates the chance to collaborate with a professional colleague outside of their specific discipline, negatively impacting a candidate's ability to develop critical skills needed to become an effective in-service educator. As noted by Putnam and Borko [21], individual teachers across disciplines have refined skills in different areas of expertise, and when engaging in interdisciplinary collaboration, have the opportunity to enhance and advance each other's collective understanding. Additionally, research has shown that interdisciplinary collaboration provides educators with opportunities to develop competencies in addressing the needs of diverse learners [20], which are essential skills to develop as learner variability increases in general education classrooms. Finally, research continues to demonstrate the benefits interdisciplinary collaboration has in presenting more inclusive educational opportunities for all students, with notable increases in an educator's willingness to present inclusive opportunities for students when the educator had experience with interdisciplinary co-teaching during their pre-service education program [22].

To address this scarcity, Education Preparation Programs (EPPs) need to include collaborative efforts of both fieldwork and instructional coursework. Research has shown that introducing pre-service candidates to co-teaching methodology may (a) provide an opportunity for candidates to acquire collaborative skills necessary for engaging in effective communities of practice [23]; (b) increase the degree of observation, dialogue, and critical reflection pertaining to evidence-based teaching and learning practices [24]; (c) provide candidates with increased emotional and professional support, positively impacting personal levels of confidence and professional development [25]; and (d) positively impact candidate self-efficacy and overall student performance [26]. Additionally, there is empirical evidence to support increases in the positive attitudes of pre-service candidates towards co-teaching,

noting increases in self-confidence when delivering instruction using this collaborative model and willingness to engage in co-teaching once in-service.

Given the identified importance of interdisciplinary collaboration on the positive outcomes of students with and without disabilities, it is imperative that pre-service candidates across EPPs are provided with instructional contexts that focus on effective co-teaching practices across each of the phases of learning (i.e., acquisition, fluency, maintenance, generalization), with the ultimate goal of increasing candidates' knowledge, recognition, and application of these practices. Therefore, this study used a mixed-methods design to determine the degree to which pre-service interdisciplinary groups of undergraduate education candidates at one institution recognized co-teaching skills and behaviors in practice. More specifically, this study sought to answer the following research question: To what degree do pre-service interdisciplinary groups of undergraduate education candidates recognize co-teaching skills and behaviors in practice?

2. Materials and Methods

2.1. Participants

Thirty-three undergraduate candidates participated in the study. Candidates from every education program at the institution participated: 2 performing arts, 4 visual arts, 2 secondary/high school, 13 elementary, and 12 special education. Thirty-one candidates identified as females, along with one candidate who identified as male and one who identified as non-binary. Two elementary candidates were German foreign exchange students. Candidates identified racially as four African American, two Asian, two Hispanic, and twenty-five Caucasian. Participants were placed in eight groups of three to five candidates each, depending upon program and interest area. At least one special education candidate was placed into each group with two to four other candidates from a program area. The eight groups included one group of candidates interested in teaching grades K-1, three groups of candidates interested in teaching grades 2–3, one group interested in teaching grades 4–5, one secondary group, one visual arts group, and one fine arts group.

2.2. Setting

The education candidates were members of three sections of two courses at one large southeastern university. The two courses, *Modifying Instruction for Diverse Learners* and *Integrated Instructional Applications in Special Education*, included candidates from all programs at the institution and were part of their required coursework. The course for the arts, elementary, and secondary program candidates could be completed by either juniors or seniors. The course for the special education candidates was designed to be taken by seniors.

2.3. Measure and Materials

The candidates rated two videos provided by the instructors, one publicly available on YouTube and one from the ATLAS, a library of teaching strategies submitted by National Boards teaching candidates. Each video was approximately 20 min in length. The example video was of a co-taught middle school class, with the lesson being on histograms. The two teachers provided instruction to the entire class using an interactive whiteboard. The non-example was of a co-taught high school classroom, with the focus of the lesson being on cloning. The lesson was discussion-based, with questions directed to the entire class. The candidates used the Co-Teaching Core Competencies Observation Checklist [27] to document ratings of observed indicators of best practice in co-teaching that were organized by 12 "look-for" indicators (e.g., Both teachers engage in appropriate behavior management strategies as needed and are consistent in their approach to behavior management) and five "listen-for" indicators (e.g., Co-teachers use language ("we", "our") that demonstrates true collaboration and shared responsibility). The candidates rated both videos individually using the measure and then met as a group to derive a consensus score. See Table 1 for the full list of indicators.

Table 1. Indicators in the Co-Teaching Core Competencies Checklist [27].

Look For Indicators	
1. Two or more professionals working together in the same physical space.	2. Classroom environment demonstrates parity and collaboration (both names on board, sharing materials and space).
3. Both teachers begin and end class together and remain in the room the entire time.	4. During instruction, both teachers assist students with and without disabilities.
5. The class moves smoothly with evidence of co-planning and communication between co-teachers.	6. Class instruction and activities proactively promote multiple modes of representation, engagement and expression (Universal Design for Learning-UDL).
7. Differentiated content and strategies based on formative assessment are used to meet the range of learning needs.	8. Technology (to include assistive technology) is used to enhance accessibility and learning.
9. A variety of instructional approaches (5 co-teaching approaches) are used, including regrouping students.	10. Both teachers engage in appropriate behavior-management strategies as needed and are consistent in their approach to behavior management.
11. It is difficult to tell the specialist from the general educator.	12. It is difficult to tell students with special needs from the general education students.
Listen For Indicators	
13. Co-teachers use language (“we”, “our”) that demonstrates true collaboration and shared responsibility.	14. Communication (both verbal and non-verbal) between co-teachers is clear and positive.
15. Co-teachers phrase questions and statements so that it is obvious that all students in the class are included.	16. Students’ conversations evidence a sense of community, including peers with disabilities and from diverse backgrounds.
17. Co-teachers ask questions at a variety of levels to meet all students’ needs (basic recall to higher-order thinking).	

Each indicator had a potential rating in the range of 0–3. The description for each rating was unique to the indicator. For example, the ratings for Look For Indicator 10 described a rating of 0 as “There is no obvious plan for behavior management, nor do adults appear to communicate about how they are approaching class management; possibly inappropriate class management”; a rating of 1 as “Very little classroom management; mainly conducted by one teacher”; a rating of 2 as “Behavior management strategies are utilized but there is very little clear evidence of how adults have communicated about their use”; and a rating of 3 as “It is evident that adults have discussed how they will approach classroom/behavior management and adults are consistent in their approach”.

2.4. Design

A mixed-methods approach to the study was applied. Both quantitative and qualitative data were collected using student ratings and recordings of group discussions. Quantitative data were collected using the group consensus ratings for each indicator on the observation checklist. A total of 34 ratings—17 indicators for each video—were collected from each group. As this study examined co-teaching practices, it was important to determine if groups of potential future co-teachers could recognize the indicators when working together.

Qualitative data were generated using transcripts from videos of the group consensus rating sessions. These transcripts were coded for the process each group used to come to consensus ratings and the reasons each group provided for decided upon consensus ratings. The first and third author conducted multiple readings of two transcripts and research

literature on co-teaching and collaboration to generate the first codebook of inductive and deductive codes. The first three authors used one additional transcript to create the second codebook and used a fourth to create the final codebook, which was then applied to all eight transcripts. Three versions of the codebook were created, with the final version including nine major codes, with three of those codes separated into subcodes. See Table 2 for the final codebook.

Table 2. Final codebook.

Codes	Description	Sub-Codes
1	Not engaged in assignment	
2	Missed opportunity to share expertise	
3	Instrument- descriptive language for each rating or nuances between the ratings unclear to candidates	
4	Reasoning/evidence for ratings provided	Identifying examples from the video
		Drawing on prior knowledge
		No reasoning/vague responses/limited discussion
		Personal bias in reasoning for rating
5	Couldn't evaluate the practice (didn't want to be too harsh)	
6	(In)ability to recognize "disability" in a video	
7	Recognition of UDL in action	No discussion of UDL
		Discussion of UDL
8	Recognition (or lack thereof) of instructional evidence-based practices (EBPs)	Academic EBPs
		Behavioral EBPs
9	Obvious video content for rating	

2.5. Data Collection

The assignment and groups were communicated with candidates in September 2023. The first and second authors instructed candidates to complete the ratings of each video individually and then meet as a group to come to consensus. In October 2023, each group recorded their meetings for consensus ratings in Zoom at times that were convenient to the group members (i.e., outside of class time). Candidates submitted the consensus rating form and Zoom recording for each group as a course assignment to their corresponding course instructor. Once the assignment was graded, the first author shared and collected the informed consent from willing participants, which made clear that participation in the study was not required as part of the course or assignment, to avoid any coercion.

The first and second authors used the observation checklist and rated both videos individually. Rater agreement between the two authors was 33/34 ratings, resulting in 97% initial agreement. The authors came to consensus using video evidence for the single discrepant rating item for one video.

Notta (Version 6.13.0), an Artificial Intelligence (AI) tool, was used to generate the transcripts from the Zoom recordings. The third author corrected the AI transcripts for any errors or missing words. The corrected transcripts were then sent to every candidate for member checking. No additional corrections were made after the member checking.

2.6. Research Positionalities

The first two authors were the instructors of record from the two courses from which the participants of this project were identified. The first author is a clinical professor with

29 years of experience teaching (9 in classrooms and 20 in higher education) and served as the instructor and advisor for the special education participants. She had no prior engagement with general education participants. The first author served as the primary coder for all the qualitative data with the undergraduate student (the third author). The second author is a clinical assistant professor at the same university. In addition to 16 years of educational experience teaching, the instructor taught the general education course four times prior to the semesters in which research was conducted. The second author confirmed the coded data to ensure the validity of the applied codes. To avoid any perception of influence of candidate responses within the assignment, the instructors emailed candidates to ask for consent to participate in the study after grades had been posted.

The three authors that coded the qualitative research include two white female researchers who have experience in quantitative and qualitative research, undergraduate teaching, and/or expertise in UDL and one African American female undergraduate student trained by the researchers. To reduce the potential impact of the researchers' personal perspectives, bias, and any misinterpretation of participants' voices, the research team applied different trustworthiness methods such as analytic memoing, engaging in ongoing conversations about the interpretation of data, and implementing a systematic process for coding and recoding data with verification of the codes.

2.7. Analysis

The initial analyses were quantitative and utilized descriptive statistics (number and percentage) to summarize outcomes by group and by each indicator on the checklist. The percentages were then used to identify the pass/fail results for each group and by each example. The second analysis was qualitative and used the transcript statements by individuals within each group to better understand their ratings. Three authors coded transcripts using the codes from each codebook, with a full re-coding of all data using the final codebook. We used constant comparison to analyze the transcripts. Inductive codes were created using data familiarization, identifying keywords or concepts, creating codes, and conceptualizing social interpretations of the data [28]. The unit of analysis was at the paragraph level, since the conversations illuminated the candidates' thinking. New codes were added to the code book as additional ideas were identified (e.g., code 9, obvious content in the video, was added to the final codebook, as some indicators were either present or not, and we were not capturing candidate recognition of that content in other codes).

3. Results

3.1. Quantitative

3.1.1 Pass rates by group. The rating for each group across all 17 indicators were calculated to determine if the group consensus ratings were in exact agreement with the researchers' consensus ratings. Ratings that were 60% or higher in agreement with the researchers were considered passing. The average for correct ratings across groups for the example video was 61.7% and was 68.3% for the non-example video. Group ratings ranged from 47% correct (Group 1 on the example video) to 88.2% (Group 3 on the non-example video). See Table 3 for ratings by group and indicator. Overall, five of the eight groups (Groups 2, 3, 5, 6, and 7) passed for the example video, and five of the eight groups (Groups 1, 2, 3, 7, and 8) passed for the non-example video. Groups 2, 3, and 7 passed both videos. Group 4 did not pass either video.

Table 3. Ratings by group and indicator.

Indicator	Group 1		Group 2		Group 3		Group 4		Group 5		Group 6		Group 7		Group 8		Overall %	
	Ex.	Non-Ex.	Ex.	Non-Ex.	Ex.	Non-Ex.	Ex.	Non-Ex.	Ex.	Non-Ex.	Ex.	Non-Ex.	Ex.	Non-Ex.	Ex.	Non-Ex.	Ex.	Non-Ex.
1. Two or more professionals working together in the same physical space.	0	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	75	87.5
2. Classroom environment demonstrates parity and collaboration (both names on board, sharing materials and space).	1	1	0	1	1	1	0	1	0	1	1	1	1	1	0	1	37.5	100
3. Both teachers begin and end class together and remain in the room the entire time.	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	100	62.5
4. During instruction, both teachers assist students with and without disabilities.	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	100	0
5. The class moves smoothly with evidence of co-planning and communication between co-teachers.	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	100	87.5
6. Class instruction and activities proactively promote multiple modes of representation, engagement and expression (Universal Design for Learning-UDL).	0	1	0	1	0	1	0	1	0	1	0	0	0	1	0	1	0	87.5
7. Differentiated content and strategies, based on formative assessment are used to meet the range of learning needs.	0	1	1	1	1	1	0	1	1	1	1	1	0	1	0	1	50	100
8. Technology (to include assistive technology) is used to enhance accessibility and learning.	0	1	0	0	0	1	0	1	0	1	1	1	0	1	0	1	12.5	87.5
9. A variety of instructional approaches (5 co-teaching approaches) are used, including regrouping students.	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	75	100
10. Both teachers engage in appropriate behavior management strategies as needed and are consistent in their approach to behavior management.	0	0	1	1	1	1	0	1	1	0	1	0	1	0	0	0	62.5	37.5
11. It is difficult to tell the specialist from the general educator.	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	100
12. It is difficult to tell students with special needs from the general education students.	1	0	1	1	1	1	1	0	0	0	1	0	1	0	1	0	87.5	25
13. Co-Teachers use language (“we”, “our”) that demonstrates true collaboration and shared responsibility.	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	100	87.5
14. Communication (both verbal and non-verbal) between co-teachers is clear and positive.	1	1	0	1	1	0	1	0	1	0	1	0	0	0	1	1	75	37.5
15. Co-teachers phrase questions and statements so that it is obvious that all students in the class are included.	1	1	1	0	1	1	1	0	1	1	1	0	1	1	0	1	87.5	62.5
16. Students’ conversations evidence a sense of community, including peers with disabilities and from diverse backgrounds.	0	0	1	0	1	1	1	0	1	0	0	0	1	1	0	0	62.5	25
17. Co-teachers ask questions at a variety of levels to meet all students’ needs (basic recall to higher order thinking).	0	1	1	0	0	1	0	0	0	1	0	1	1	1	0	1	25	75
Overall	52.9	76.4	64.7	64.7	76.4	88.2	52.9	58.8	64.7	58.8	70.6	52.9	64.7	76.4	47	70.5		

Researchers examined the passing ratings by Look For and Listen For indicators across the two videos. Five groups (Groups 2, 3, 5, 6, and 7) passed the Look For indicators for the example video, and all groups passed the Look For indicators for the non-example video. Seven groups (all but Group 8) had passing ratings for Listen For indicators for the example video, and five groups (Group 1, 3, 5, 7, and 8) passed for Listen For indicators for the non-example video.

3.1.2 Pass rates by indicator. Overall, when aggregating ratings across all groups, 23 of 34 indicators (17 indicators for each video) were passed (11 for the example and 12 for the non-example). Indicators 1, 3, 5, 9, 13, and 15 had pass rates above 60% for both videos. Zero indicators were not passed on both videos. Zero indicators were passed at 100% on both videos. However, no group rated indicators 6 and 11 correctly for the example video or indicator 4 for the non-example video. Conversely, indicator 11 was rated 100% correctly for the non-example video and indicator 4 was rated 100% correctly for the example video. Only Group 6 rated indicator 8 for the example video. Seven indicators (indicators 12 and 15 for the example; indicators 1, 5, 6, 8, and 13 for the non-example) were rated correctly by seven of the eight groups across the two videos.

3.2. Qualitative

To better understand the candidates' reasoning for their ratings, transcripts of the consensus meetings were examined. Using the final codebook with both inductive and deductive codes, researchers re-coded the full set of transcripts. While every code was represented in the transcript, evidence within the discussion giving insight into the thinking of the candidates as they completed the assignment focused around seven codes. Code 2 was "missed opportunities to share expertise", which occurred each time rating errors were made, and code 9 was evident (e.g., both teachers remain in the classroom [indicator 3] and co-teachers use language that demonstrates true collaboration and shared responsibility [indicator 13]) and often discussion was not needed to come to consensus. Codes reflected reasons for errors and accurate ratings.

3.2.1. Not engaged in assignment (code 1). Within some groups, members appeared to be either unengaged in the task or unprepared with their own ratings prior to the meeting. It was difficult to discern if the consensus ratings were accurate representations of candidates' knowledge, or if it was the result of the candidates' level of engagement in activity and effort within the activity. For example, one member of Group 1, when discussing indicator 11, gave evidence for their rating but seemed to give in to ratings of others within the group rather than discuss the item.

> Speaker 2: I said three, zero because I thought it was very obvious.
>
> Speaker 4: Yeah, sure, I see that, yeah.
>
> Speaker 2: It's not even because she was doing something that was like specialized, but like, because she didn't do anything. They weren't doing a lesson. Like we got to give them that, but like, she wasn't doing anything to help with the discussion. Like she would just like, type in every once in a while. And it was nothing really of, "bring the meat" really to it. You know, but I'd be fine with the one. I'd be fine with that. I don't really care.

3.2.2. Instrument- descriptive language for each rating or nuances between the ratings unclear to candidates (code 3). For some indicators, the candidates discussed their confusion or dislike for the way the descriptions for the ratings within the instrument. For indicator 8 in particular with the example video, candidates struggled with the use of technology and the word "multiple" in the descriptor for a score of 3 (Multiple technologies are utilized to make materials and content accessible and are used regularly). As most of the candidates were looking for equipment (versus technology), most groups came to the wrong consensus for the indicator.

> Speaker 2: I gave it a one because I feel like it was a limited use of technology. Like, I don't think there was like multiple. . .

> Speaker 1: Oh, I didn't see where it said multiple. I didn't realize. I thought it was just used as technology. Like no, I thought it was like, okay, three.
>
> Speaker 4: I put one.
>
> Speaker 5: Well, yeah. That does make more sense.
>
> Speaker 1: Okay, yeah, I definitely agree. I didn't see the multiple. I didn't see the multiple. I just thought it was used as technology. Okay, so that one will be a one. (Group 5)

3.2.3. Reasoning/evidence for ratings provided (code 4). There were a number of instances when the candidates provided evidence and drew on their prior knowledge to discuss the reasons for their ratings. For example, Group 6 discussed the evidence that lessons were co-planned between the two teachers for the example video for indicator 5 (an indicator that groups correctly rated 100% for the example video and 87.5% [one group was incorrect] for the non-example video).

> Speaker 2: What are we on? "The class moves smoothly with evidence of co-planning and communication between co-teachers". I said three because I think it was very evident that they both completely knew the lesson plan and they were able to keep things moving the whole time. And like if one teacher was walking around checking on the groups, the other teacher was presenting, and they could switch back and forth very easily without having to like take a second and talk about it.
>
> Speaker 1: Yeah, I very much agree with you. It was so fun to watch them, because they were so well rehearsed. There was not a minute that wasn't perfectly smooth.
>
> Speaker 3: I honestly couldn't spend that much time planning like they do. They'd probably spend their whole lives planning something.
>
> Speaker 1: Yeah, it was very impressive for sure. So three?
>
> Speaker 3: Yeah.

All groups provided evidence from the video during their discussion to support their ratings. Group 4 discussed indicator 4 for the example video and provided details for their accurate rating.

> Speaker 3: I said three again for the next one that, "during instruction both teachers assist students with and without disabilities", because I saw both of them going around and talking to students.
>
> Speaker 1: Yeah, and I think it was so well done. I wasn't really able to tell which students were the ones that were for that specific teacher and the ones that the teacher was supposed to be working with and the ones that the general ed teacher was working with, because they worked so well with all students. They knew all the students' names. It was very organized.
>
> Speaker 2: Yeah, I definitely agree with the three rating. They were definitely... you couldn't tell, like you couldn't distinguish kids with disabilities and kids without disabilities or the special educator from the general educator. All right. I also said three for the next one, "the class moved smoothly with evidence of co-planning and communication". It was like they had rehearsed it. They were like bouncing off of each other. It seemed like they knew how the lesson was going to progress and when there was going to be like extra explanation given.

Group 7 discussed indicator 9 for the example video and came to the accurate conclusion using evidence from the video.

> Speaker 2: And then the next one I said one.
>
> Speaker 1: Yes, I had a one as well.

Speaker 3: For [Indicator 9]? I had a 3 on this, but I don't remember why.

Speaker 2: Well, the reason, so the reason I said one was just because two is like regrouping students. Um, and that didn't happen. And then it just seems like a lot of like, it wasn't necessarily one teach one support, because they're both kind of teaching, but, and both supporting. But they didn't really like use any other kinds of co-teaching approaches. That was a hard one. Cause it was like, you're not quite like a two, but you're not like, one doesn't justify it, you know.

Speaker 3: When I'm looking back to three ratings [the rubric] says at least one of the approaches involves regrouping, which they definitely didn't do. So I'm going one.

Speaker 1: Yeah, they did not do that.

3.2.4. Couldn't evaluate the practice (didn't want to be too harsh) (code 5). Several instances were identified with the non-example video in which candidates "felt bad" or "didn't want to be too harsh" with their rating. For example, Group 3 discussed indicator 4 for the non-example (the indicator no group rated correctly for the non-example).

Speaker 2: Okay, I also say zero for the next one, but you are kind of being nice to her, so I'd be good if you put a one.

Speaker 1: I put a zero for this one too. Just because like there's clearly a distinction, like we have the room teacher and like she's sitting on a desk, like you know what I mean, so yeah.

Speaker 4: Yeah, I put a 1, but I definitely think that was probably a zero. Yeah.

Speaker 3: Yeah, I also put a one, but I think it was just because I. . . Yeah.

Speaker 4: It just felt bad. I really don't know. Yeah.

For indicator 11 for the non-example video, every group rated it accurately. Group 5's discussion included conversation about not wanting to be too harsh on the teachers in the video.

Speaker 1: So I put a zero because I could definitely tell that the teacher in the back was probably like the special education teacher and the teacher at the front was the general education teacher. That's what I got from it. Yeah.

Speaker 2: I got one, because that the other lady that was like on the table she did like switch roles a little bit and talk like at least like twice—so I think we can give her a little bit of credit.

Speaker 1: A little bit, okay, okay, I can, if she did talk, then I could see giving it a one. I just don't feel like they necessarily like switched roles and stuff.

Speaker 3: Yeah, I don't think they switched roles.

Speaker 2: Okay, we can put a zero.

Speaker 1: We're not trying to bash the women. I just don't feel like it was necessarily switching like leadership roles.

3.2.5. (In)ability to recognize "disability" in a video (code 6). Seven out of eight groups were able to correctly recognize students with disabilities engaging in inclusive learning experiences with their peers without disabilities in the example video. Group 2 engaged in collaborative discourse focused on the inclusive opportunities they were able to identify for students with disabilities.

Speaker 4: . . .students [with disabilities] weren't separated from the class or in the back of the room, they were all in the same place doing all the same things. There weren't students that were asked to do different assignments, they were all included and integrated seamlessly in the activities.

While this quote provides evidence of candidates' considerations when discussing variations in student populations within a classroom, it also highlights an example of a missed opportunity for the special education candidate in this group to share their expertise (code 2). As a follow-up to this statement, it would be anticipated the special education candidate may provide their colleagues with insight as to best practices in inclusion and co-teaching. Conversely, in reference to the non-example video, only two out of the eight groups were able to recognize students with disabilities in comparison to their peers without disabilities, as highlighted by comments made during Group 8's discussion.

> Speaker 3: I can't necessarily tell what students had like special needs here in this case [video]. . . I think the problem was that like you couldn't guess which students just had the disabilities.
>
> Speaker 4: I just put a zero because I had no idea.

3.2.6. Recognition (or lack thereof) of UDL in action (code 7). For indicator 6, 50% (4 out of 8) groups were able to correctly identify principles of UDL in the example video. As candidates in Groups 2 and 8 examined application of these principles in the video example, they noted evidence of multiple means of engagement and offered suggestions for consideration as to ways the lesson could have been enhanced by presenting multiple means of action and expressions.

> Speaker 1: I said that there were like some, I said like students were able to turn and talk, which we said that was one. I said there was some writing and then there was one like touch on the board. So they did have a few opportunities for like all students. . .. But they did have a couple, a couple of ways for engagement for all students. (Group 2)
>
> Speaker 3: Maybe they could have like, for some students who don't write that fast, they couldn't have like given them a worksheet where they already had a definition and just had to put in a few of the words. So I think they could have improved it even more. (Group 2)
>
> Speaker 3: There was one thing, also, at the beginning of the class, I thought that it was like going back to the like UDL parts, like internalizing things. They really gave the students the expectations at the beginning of class when they had to read that like "I can" statement and ask them to like verify how they gain their knowledge; like when they would ask them the like, "How do you know how you got that answer?" And they were often guided in the note taking, understanding information that they were given. But obviously I think that there could have been more ways that they made it more like—yes, they collaborated in groups, but they could have offered different ways of learning for them. You know, they had them draw a couple pictures in their notebooks and write some notes, but there wasn't a lot of like—I don't know, the students could have displayed their knowledge in different ways. (Group 8)

In comparison, 100% of candidate groups were able to correctly identify the lack of evidence of UDL in the non-example video, with Group 4 noting limited opportunities for student engagement and variety in the students' ability to demonstrate their understanding of instructional content.

> Speaker 4: Yeah. I just felt like it was—they did the same thing the whole time. There's no other option.
>
> Speaker 1: And it was just the teachers calling on the students, it wasn't like opportunities for the students to like share their knowledge with classmates, it was more so like them saying it out loud to the teacher back and forth, back and forth.

3.2.7. Recognition (or lack thereof) of instructional EBPs (code 8). Only one group correctly identified the application of technology in the example video (indicator 8). While

both the teachers and some students used the Promethean board in the video, Group 2 candidates, for example, discussed the lack of use of individual student technology as the reason they did not rate the example video higher. The rich discussion of Group 6 (the only group to accurately rate indicator 8) provides insight into their thinking.

> Speaker 2: "Technology to include assistive technology is used to enhance accessibility and learning". I said two because they're using the board the whole time and it's used the whole time to show the information, but it's also used to have students come up and like write on it or adjust the graphs or something but they're not like they don't individually have technology so that's why I did it two.
>
> Speaker 3: I said three just because I got confused because it says intermittently and sporadically, they didn't sporadically use the board. They used it throughout the entire lesson, like even through the end of class, and the kids coming up to the board. So that's why I put three because I didn't feel like the board was used intermittently throughout the lesson. But I can see why you put two. . .
>
> Speaker 2: Yeah, I think I thought they're using it the whole time, but then I said, well, students sporadically actually go up to it and write on it, and it is the only technology, so I didn't want to give that extra point because it's the only one they're using instead of each student or each table having a different form of technology.
>
> Speaker 1: Mm hmm. I also said three, because a smart board is such a great way to engage students, as well as keep them on task and a little self-motivation. Um, and it was used the whole time in different ways. . .It was like in the beginning to write the definition and had that starting statement. It had like it proceeding like it went along with the lesson pretty well. And I like what you said, Chloe, that like each student could have a technology at the desk. But when it gets to that point, it does get a little more difficult with different ways and what they know how to use technology. And then that will require like a pre-lesson to that to then kind of teach them how to use it, which is great if you want to incorporate more technology. But being realistic in middle school setting, it's hard to kind of counteracting that they do all usually have Chromebooks now, just because of the COVID era. So, yeah, I think in like the saying it was now that smart board was used well and used effectively. But if maybe we were going to co-teach it ourselves, we could incorporate some Chromebook technology or something in it.
>
> Speaker 2: Yeah, I feel good with a three based on that.

For Indicator 10, Group 1 candidates did not recognize behavior management techniques employed by co-teachers in either video, as the candidates appeared to be looking for student misbehavior to assess the teachers' use of behavior management strategies.

> Speaker 1: Okay, moving on: "Both teachers engage in appropriate behavior management strategies as needed and are consistent in their approach to behavior management". I said a two for the first one and a one for the second one.
>
> Speaker 3: Yeah, I would agree the one for sure, like give it a one. . .Second one was, definitely, it'd be a three for that one.
>
> Speaker 4: Yeah, I put a two for the first one, and then a one for the second one, because the second one, it's obviously—I think it was one teacher that's what she was doing. And I mean, that could be like, you know, it could be both of them, like if the one that was like leading and talking did some behavior management, but I mean, walking through the kids is kind of behavior management, because you're monitoring the activity.

> Speaker 2: So he [student] needed some more than that. Proximity wasn't gonna work.
>
> Speaker 1: Yeah. Honestly, I think it was, just—yeah, two and one. Well, I was just gonna say it's kind of hard to observe like how the teachers are managing behaviors, because I feel like the students in both of these classrooms are relatively well behaved, especially the first one, like nobody, no students seem to cause any trouble. So I was like, it's kind of hard to rate them on how they're managing behaviors when there's not many behaviors to manage. The second one, there was a kid that seemed like talk a lot or whatever. But even then, like the teacher seemed to like handle the classroom discussion well.

4. Discussion

The purpose of this study was to determine the degree to which pre-service interdisciplinary groups of undergraduate education candidates recognize co-teaching skills and behaviors in practice. Quantitative data provided information about which components of co-teaching candidates were and were not able to recognize when effective practices were and were not evident. Qualitative data were then used to understand the reasoning candidates used to come to consensus decisions. These combined results gave us deeper insight into the nuanced understanding of potential future co-teachers.

Overall, it is important to note the pass rates across the groups were moderate or poor. Only one group scored above 80% on one video. As both course instructors (the first and second authors) expected candidates to have a deeper understanding of co-teaching and associated concepts (e.g., classroom management, UDL), the overall ratings were surprising. As a result of the overall poor performance, it was critical to understand how groups came to consensus ratings (e.g., what evidence was used to determine the rating and how groups interacted during their meeting) to get a picture of why the ratings were not good. Candidate discussion indicated erroneous consensus ratings were a result of either a lack of knowledge, the inability to recognize the concept in practice, or a lack of effective engagement in the actual activity.

The lack of recognition of EBPs for behavior and instruction in practice was unexpected. There are multiple courses in candidates' programs targeting a range of EBPs in areas such as classroom management, technology, and UDL. Yet, candidates were not able to recognize common practices in these areas. As candidates may not have had field experiences in inclusive settings to see co-teaching in practice, or if they did have those types of experiences, they may have not been observant of the co-teaching practices they were being exposed to. It may be that without explicit support during field experiences, candidates may not be cognizant of their lack of knowledge and will not be looking for specific concepts or practices in the field without some level of direction.

The results highlight that some indicators were more challenging for candidates across the different contexts. For example, the candidates could differentiate the specialist from the general educator (indicator 11) for the non-example video but struggled to determine the difference between the two in the example video, while both experts were able to do so. As all groups rated indicator 11 for the example video as a 3 (no discernible difference between the educators), and experts rated it as a 2 (parity for most roles and responsibilities), every group got that item incorrect. A similar but inverse result occurred for indicator 4: all groups were able to rate the indicator (both teachers assist students with and without disabilities) in the example video at 100% but at 0% in the non-example. Most groups rated this 0 (adults only helping their "own" students or not helping students), whereas both experts rated it as a 2 (both adults are willing to help all students, but students seem to have one adult they prefer to work with). Candidates were unable to interpret the dynamic in the non-example classroom between the two educators. Additionally, no groups accurately rated indicator 6 (class activities and instruction promote UDL) in the example, which was rated accurately by all but one group in the non-example. Of interest is that this indicator is the only one in which the experts disagreed about their initial ratings for the

non-example video. The candidates seemed to focus only on the engagement of the learners and opportunities to respond but missed any evidence of principles of representation as well as action and expression.

Other indicators (e.g., 5, 13) rated more consistently across groups and videos. These indicators were about evidence of co-planning and language reflecting shared responsibility. It may be that these types of co-teaching behaviors were either more observable or apparent in the videos. As the contexts within the two videos were vastly different, the candidates were potentially more able to effectively apply their background knowledge of co-planning within their ratings.

As most educator preparation programs teach content initially to build candidate knowledge and then expect the application of skills in practice, it is not reasonable to expect candidates to apply the practice without building opportunities to recognize the skill in practice. As co-teaching is an instructional model often used in general education classrooms for students with and without disabilities [29], it is reasonable to expect that candidates in this study will engage as co-teachers during their careers, if not during their student teaching. In general, the candidates in this study were not able to use their prior knowledge to recognize co-teaching behaviors in action.

How the candidates engaged with co-teaching tasks seemed to vary across groups. For example, Group 7 spent 13 min getting to know each other and learn about each other's programs before starting the assignment. Group 8 discussed how much they enjoyed the chance to work together. Conversely, Group 1 had participants who responded to several indicators as "whatever you think. I don't care". While the makeup of the groups replicated what often occurs in schools, with the special educator engaging with numerous general education teachers, the limited prior engagement that interdisciplinary candidates have with each other could influence the interactions when consensus is necessary. As the candidates were juniors and seniors in their undergraduate programs, the sharing of expertise within this collaborative activity varied within groups. As a result, candidate expertise may not have been capitalized upon during consensus discussions, which could have led to inaccurate ratings.

4.1. Limitations

Three limitations should be noted within this study. First, candidates had to find time outside of class times to complete the task. Candidates reported this as a major challenge to completing the assignment, which could have impacted their engagement. Second, course instructors provided directions for the assignment that included a scoring rubric focused on interdisciplinary collaboration. The assignment was graded for the submission and collaborative engagement versus accuracy of responses. While the candidates were education majors, this type of submission could have influenced the level of effort candidates put into the ratings. Finally, in each group of 4–5 candidates, there were only 1–2 special education candidates. As the general education candidates may have been familiar with each other from previous courses (e.g., the elementary candidates), the familiarity (or lack thereof) with each other could have influenced the sharing of their expertise during the discussion.

4.2. Implications for Policy, Practice, and Research

There are several implications for policy, practice, and research emerging from this study.

4.2.1. Policy. As EPPs follow state and federal policy for content of teacher education programs, it is necessary to ensure that all education candidates, including general education candidates, engage in coursework and field experiences that address collaborative behaviors. Every state has expectations for professional conduct, which includes language around engaging in professional behaviors. In 2009, Muller et al. [30] reported that 10 states provided guidance or policy to districts regarding the use of co-teaching in schools as a collaborative instructional model. As each state approves EPP programs and has established standards for each program, it is necessary that states ensure that those standards match the current reality of schools. EPPs need to be certain they are following

state policy and guidelines and addressing the expectation for professional collaboration in programs beyond their special education programs.

4.2.2. Practice. Of critical importance is the alignment between the collaboration and co-teaching experiences in EPPs for pre-service candidates and the expectations for co-teaching in schools for in-service candidates. The results of this study indicate that candidates are not ready to be practicing co-teachers and need more directed opportunities to engage in activities to build their knowledge, recognition, and application of effective co-teaching behaviors. Additionally, EPPs must prepare candidates to work in interdisciplinary teams. As each candidate is building expertise in their discipline, supporting pre-service candidates to develop leadership skills and recognize the opportunities to share that expertise is an essential for effective collaborative teams. Finally, EPPs likely need to design opportunities for candidates using explicit instruction to build fluency to not only recognize what is and is not effective co-teaching behaviors but exhibit those behaviors in their own teaching practices. As there are more teacher shortages in every content area internationally [31], co-teaching is a model that has been recommended as a way to combat these shortages to better prepare candidates [19] and meet the needs of their future learners. Without opportunities that infuse EBPs within co-taught planning and instruction, pre-service candidates in any field are not prepared adequately in their licensure programs. EPPs can inadvertently perpetuate separatist education for children by training future educators in separate programs with very limited course overlap and exposure to candidates in different programs. Many education pre-service programs are siloed for candidates; general education and special education programs have few courses that overlap, often including nothing more than an introductory-level course about the history of education or the characteristics of students with disabilities [32]. Inclusion of individuals with different abilities in classrooms, schools, and communities is only possible when general and special educators have common preparation and are supported to be collaborative professionals. General education and special education programs need more collaborative experiences for candidates that consider the needs of all learners—those with a range of abilities. With consistent co-teaching experiences and intentional collaborations across courses and programs, candidates would be better situated to design and implement inclusive and equitable lessons that would benefit a wide range of students [33].

4.2.3. Research. There are research studies that indicate significant improvement for student achievement—both students with and without disabilities—when co-teaching is used as a service delivery model e.g., [8,11,19]. There is much less research about the preparation of co-teachers, both in-service and pre-service [34], and their self-efficacy [20]. It is important to understand how much exposure to effective co-teaching behaviors is necessary for pre-service candidates and in-service educators to be able to recognize best practices and subsequently use best practices to implement co-teaching within instruction. Additionally, it is critical to engage with co-teachers about the conditions and context that create effective co-teaching. We found the context within the video directly impacted candidate understanding and ratings. While there is some research asking co-teachers about what is needed for effective co-teaching practice e.g., [35], the need for more research to examine the impact of conditions across contexts is warranted.

5. Conclusions

This study investigates the degree to which pre-service interdisciplinary groups of undergraduate education candidates recognize co-teaching skills and behaviors in practice. While candidates in this study had poor to moderate levels of success identifying effective co-teaching behaviors consistently across two contexts, as evidenced in the quantitative data, the qualitative data illuminated their varied knowledge levels, the inability to recognize EBPs in practice, and varied levels of engagement in the activity. As these candidates become educators, it is very likely they will collaborate with other education professionals and possibly become co-teachers. It is necessary that EPPs are designing

explicit opportunities for learning and growth, which support their candidates to fulfill those roles effectively.

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