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Helping Pre-Service Teachers Transition to the Role of Teacher Through Co-Planning

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Reauthorization of the Individuals with Disabilities Education Improvement Act IDEIA, reaffirmed that students with disabilities should be taught in their least restrictive environment. This emphasis on inclusion has led to a stronger focus on collaboration and co-teaching practices between general and special-education teachers. Utilizing a co-planning process, this study sought to identify the barriers, strategies, and resources that pre-service teachers (PSTs) recommended for students on Instructional Education Plans (IEP). The authors used a qualitative data analysis framework to examine extensive data from 14 groups (n = 28) of mathematics and special education pre-service teachers. Results found that most math and special education PSTs identified mathematical content barriers aligned to IEPs, yet were not specific regarding the instructional practices they would employ while utilizing few research-based resources.

Keywords: co-planning, co-teaching, mathematics education, Pre-service teachers, special education

According to the Council for Exceptional Children (Cook et al., 2024, p.206), "co-teaching is a collaborative approach to instruction in which two teachers, typically a general education teacher and a special education teacher, work together to plan and then implement instruction for a class that includes students with disabilities." Co-teaching and collaboration are essential skills for special education teachers, as described by the Council for Exceptional Children's Professional Standards for Teacher Preparation (2020). The purpose of working together is to support students' diverse needs in inclusive classrooms (Xin et al., 2022). This collaborative process pertains to planning, teaching, and assessing students (Brendle et al., 2017; Magiera, 2020; Zadorozhna et al., 2020;). Co-planning enables teachers with specialized

knowledge and skill sets to develop learning experiences that maximize students' learning outcomes across a wide range of needs. Co-planning is an important mechanism for supporting students with and without disabilities in inclusive classes. The following models, identified by Dieker (2003, expanded upon Friend and Cook's (1995) models, can be used within a co-teaching classroom:

- One Teacher Teaches and One Observes: One teacher leads the instruction, while the other gathers student learning or behavior data.
- One Teacher Teaches and One Assist: One teacher instructs the whole class, and the other provides individualized support to students.
- Station Teaching: Students rotate through various stations, each facilitated by one of the teachers or set up for independent work.
- Parallel Teaching: The class was divided into two groups, with each teacher instructing one group on the same or different content.
- Alternative Teaching involves one teacher working with a larger group, while the other works with a smaller group, often for reteaching or enrichment purposes.
- Team Teaching: Both teachers co-deliver instruction, often presenting different perspectives, demonstrating debates, or engaging in role play.

For co-teaching to be effective, it is recommended that teachers co-plan (Brendle et al., 2017; Marzocchi et al., 2021). This process involves defining learning goals, dividing lesson responsibilities, and ensuring that each teacher uses their strengths to contribute to the lesson (Marzocchi et al., 2021). However, researchers have found that mathematics and special education teachers often focus on procedural knowledge over deeper conceptual understanding, which can limit students' learning opportunities (Booth & Newton, 2012; Fuchs & Fuchs, 2002). One way to overcome this is to anticipate how students will engage with tasks and consider accommodations for IEPs.

Strategies used to co-plan include understanding and implementing Universal Design for Learning processes (UDL), inquiry-based learning, using scaffolds, collaborative peer activities, and explicit instruction to support diverse needs (Magiera, 2020; Xin et al., 2022). Small group instruction has also been highlighted as an effective strategy within inclusive classrooms, allowing for more targeted and intensive teaching for students with disabilities (Magiera, 2020). It is essential to ensure that both concrete and abstract representations are included in mathematical content (Xin et al., 2022). According to Cayton et al., (2017), teachers should also develop flexible lesson plans that can be modified based on student performance and feedback.

Collaborative processes involve a few barriers. One barrier is the lack of sufficient planning time, which can hinder co-teachers' ability to fully collaborate on lesson development and adaptation (Magiera, 2020). Another barrier is the potential for one teacher, often a special education teacher, to

take a subordinate role, leading to less effective instructional collaboration. This dynamic can limit the co-teaching benefits for students with disabilities (Magiera, 2020; Cayton et al., 2017). This barrier is somewhat ironic, given that training in co-teaching and professional collaboration is a staple of special education teacher training, but much less common among general education teachers (Kim & Pratt, 2020).

The co-teaching collaboration process can be challenging for pre-service teachers because of their limited experience and understanding of co-teaching (Brendle et al., 2017; Zadorozhna et al., 2020). Teacher candidates reported difficulty modifying content for these students in a co-teaching environment, particularly when they did not have prior knowledge of the student's specific needs (Stapleton et al., 2021; Sundqvist et al., 2023). Despite using co-teaching models, some pre-service teachers doubted whether students with IEPs received the individualized support they needed (Sundqvist et al., 2023). As a result, it is important for teacher education programs to equip pre-service teachers with the skills and knowledge needed for real-world teaching roles, which often involve collaboration.

Theoretical Framework

The theoretical framework for this study is adapted from the work of researchers at the the Educational Development Center (Brodesky et al., 2002), where the authors describe a collaborative process to make mathematics more accessible to students with disabilities. The process requires the sharing of expertise, joint planning, and coordination among mathematics teachers, special educators, and service providers. Figure 1 shows the various components of the planning process. Sections following Figure 1 delineate the meaning of each element in the co-planning process.

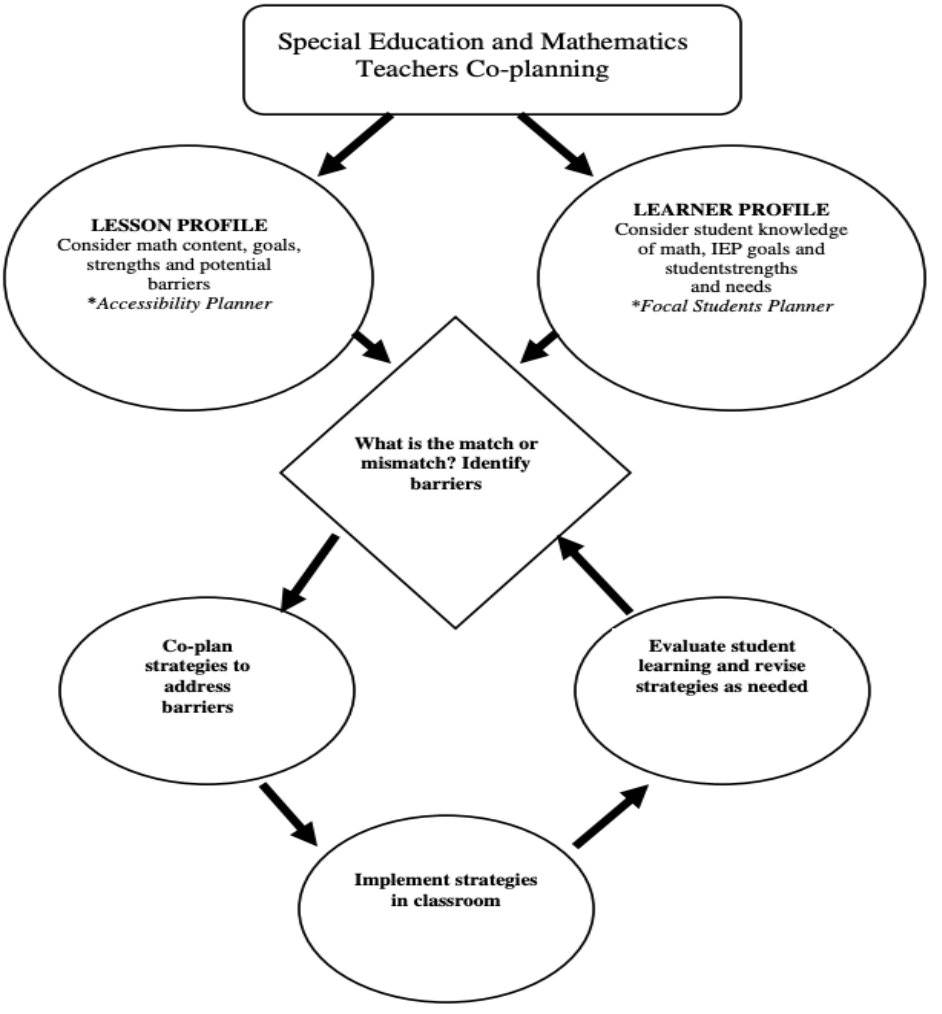
An essential element of the planning process is identifying the learners' processing skills, which may influence their success in mathematics. Brodesky et al. (2002) identified eight areas: conceptual processing, language, visual-spatial processing, organization, memory, attention, psychosocial skills, and fine motor skills. The authors provided a chart for each area to identify the types of tasks, examples of student difficulties, and accessibility strategies.

The Lesson Profile

In the lesson profile, both special educators and mathematics teachers need to begin by answering the following questions: What are the essential math goals in the lesson and what barriers might prevent all students from reaching those goals? State and national standards aim to build mathematics on a deep conceptual understanding of topics. Often, the need to "cover" topics replaces mathematical proficiency.

Figure 1

Co-Planning Process of Special Education and Mathematics Teachers



Note. Reprinted from "Accessibility Planning Process." From *A Process of Addressing Accessibility in Mathematics*, (p.2) by A. Brodesky, L. Katzman, C. Parker & E. Murray. 2002, Educational Development Center. Reprinted with Permission by Authors.

Co-plan Strategies to Address Barriers

Once barriers to the lesson are identified, Brodesky et al. (2002) recommend using a "focal student" approach. In this approach, teachers choose three students as proxies for the range of diverse learners in a class: a typical student with an IEP, a high-performing student, and one identified as on-target. This approach helps to identify students' strengths and needs and assists teachers in planning lessons accordingly.

Implementation Strategies

The next step in the co-planning process is for the special educator and mathematics teacher to implement strategies that address the difficulties students experience while ensuring that the content remains aligned with standards. Some teachers may hesitate to use differentiated tasks in the classroom, fearing that students might view them as unfair or feel uncomfortable if their work differs from that of their peers. However, these concerns can be addressed by creating a classroom culture that values and respects individual differences in learning. In such an environment, students understand that fairness is not about everyone doing the same task, but rather about each student being given work that appropriately challenges them. The expectation is that all students will put in effort to meet high standards. This approach aligns with the Teaching Principle, highlighting that "effective teaching requires a challenging and supportive classroom learning environment" (NCTM, 2000, p. 12).

Evaluate and Revise Strategies

After implementing accessibility strategies, an important question emerges: should these strategies be used for an individual student, small group, or entire class? What if they do not prove to be effective? According to Brodesky et al. (2002), the answer depends on the specific barriers to the lesson and the student population's needs. For example, students with significant disabilities may require accommodations or modifications that are unsuitable for the entire class. For instance, a student with severe attention disorder or behavioral difficulties might need frequent and repeated verbal or visual prompts to sustain attention on a task. While some accommodations are tailored for students with specific challenges, others can support a broader range of learners, helping to clarify instructions or highlight key mathematical concepts for the entire class. To provide pre-service teachers with the opportunity to co-plan using the Brodesky model, the following questions directed this study:

1. What potential barriers and misconceptions do pre-service teachers identify after analyzing learner profiles and mathematical goals in a generic lesson plan?
2. What accessibility strategies do pre-service teachers use to modify math lessons, and how do the strategies align with learner profiles?
3. How do pre-service teachers collaborate when co-planning?

Methods

Participants

The authors of this study included three education faculty members who collaborated across two Midwestern universities. The study was

conducted in one of the author's pre-service education classes: secondary mathematics (n = 15) and special education pre-service teacher methods (n = 14). Of the 14 special education pre-service students, all had dual majors: mild-to-moderate and moderate-to-intensive. All students were juniors or seniors, and were asked to collaborate during the same semester to complete the assignment for this study, thus enabling co-planning.

Procedures

At the beginning of the semester, students in the secondary mathematics class were assigned a partner in the special education teacher methods course to collaboratively work on the semester-long project. As the numbers were not identical, there was one group of three students (two mathematics and one special education pre-service teacher). Before this assignment, the students had yet to meet each other. Students were provided with each other's contact information and were asked to introduce themselves and schedule meetings throughout the semester to complete the co-teaching assignment, as outlined in Figure 2.

Figure 2

Co-Teaching Assignment

> Use the unique student profile and the generic lesson plan for the following math standard to answer questions regarding identifying barriers, co-planning strategies, and assessing the strategy:
> *7. NS.1 Apply and extend previous understandings of addition and subtraction to add and subtract integers; represent addition and subtraction on a horizontal or vertical number line diagram.*

The authors developed the following instruments and shared them with students.

- **The Learner Profile:** With the help of Chat GPT, fourteen different learner profiles representing a diverse group of middle-grade students were identified as having a physical or learning disability. The authors randomly assigned co-teaching teams with one lesson profile to be used by each team of pre-service teachers (see Figure 3 for example).
- **Lesson Plan:** The lesson plan, also created by Chat GPT, was aligned with the institution's format. The author/instructor provided all teams with the same standards and lesson plans for this assignment.
- **Implement Strategies and Identify Strategies and Resources:** Co-teaching pairs were required to collaborate by analyzing the learner profile and lesson plans. Students were required to determine the lesson's barriers to success, plan strategies for student success, and

reflect on this co-teaching process. The authors created a Google Form for student team submission.

Figure 3
An Example of a Student Profile

Disability: Attention Deficit Hyperactivity Disorder (ADHD)
Math Knowledge: Understands addition and subtraction
but struggles with staying focused on multi-step problems.
IEP Goals: Increase focus on completing multi-step math problems independently.
Strengths: Enthusiastic about math games and hands-on activities
Needs: A structured environment, timers to keep on task, and breaks between

Data Collection and Analysis

Given the lesson plan and learner profile, pre-service teachers were asked to answer questions regarding identifying disabilities, creating strategies for students with disabilities, and assessing the co-planning process. The authors utilized the framework developed by Miles and Huberman (1994) to describe the major phases of data analysis: data reduction, data display, and conclusion drawing and verification. Data display goes beyond data reduction to provide an organized, compressed assembly of information that permits conclusion drawing. The authors chose a matrix format because it helped organize more detailed data. Using data displays, whether written or visual, allowed the authors to gather information from the data to identify patterns and connections. Each of the three parts of the assignment was added to an 18 × 14 matrix, with the case labeled on the y-axis and assignment questions on the X-axis (See Table 1 for an abbreviated sample). According to Miles and Huberman, the conclusion involves considering the analyzed data and assessing their implications for the questions. Verification is linked to conclusions drawn by the authors, who revisited the data as often as necessary to crosscheck or verify these emergent conclusions. "The meanings emerging from the data have to be tested for their plausibility, their sturdiness, their 'confirmability' - that is, their validity" (Miles & Huberman, 1994, p. 11).

Table 1
Sample of One Group's Responses

Profiles	Identify Barriers	Co-Planned Strategies	Type of Collaboration
IEP Student: Elijah: Disability: Emotional Disturbance (ED) **Math Knowledge**: Can complete grade-level work but becomes easily frustrated and shuts down during challenges. **IEP Goals:** Improve emotional regulation during math tasks to maintain focus and perseverance. **Strengths:** Capable of higher-level thinking, enjoys leadership roles in group work. **Needs:** Emotional check-ins, a calm learning environment, and stress-relief strategies.	Staying focused Lack of prior knowledge Difficulty with integers Emotional calm	Extra time Adjustments to curriculum Hands-on activities Collaborative work Emotional support	Planned separately Used AI, Government, Resources Divided tasks

Results

The authors followed an emergent coding process to determine the study's findings as recommended by Miles and Huberman (1994). With 18 potential data entry points from each pair of pre-service teachers, the authors agreed on three clusters to align with three research questions: identification of barriers, co-planned strategies, and planning processes. Once the clusters and associated elements appeared stable, the three authors read and recorded all the responses. Each response adhered to at least one cluster. The last version of our coding framework included a matrix with the profiles of each student on the left and three separate columns on the right representing each cluster. See Table 1 for an example of the profile analysis.

Research Question 1: Identifying Barriers

The first objective of the assignment was to find potential barriers and misconceptions based on their specific students' profiles, including the following mathematics Number Sense Standard:

Standard: 7.NS.1 - Apply and extend previous understanding of addition and subtraction to add and subtract integers; represent addition and subtraction on a horizontal or vertical number line diagram.

Of the 14 math/special educator partners, 92% identified at least two barriers and misconceptions directly related to learners' profiles and lesson plans. Some examples include students with attention-deficit/hyperactivity disorder requiring visual aids or manipulatives, emotional regulation challenges for Emotional Disorders, and struggles with interpreting word problems for Autism Spectrum Disorder and Specific Learning Disabilities.

Groups could identify content-specific barriers, such as misunderstanding the directionality of number lines for addition and subtraction or challenges with negative integers (85%). The students' responses highlight misconceptions related to learning integer addition and subtraction on the number line. Another recurring theme is the difficulty with foundational and prerequisite skills, such as understanding the meaning of operations beyond essential addition and subtraction and applying prior knowledge to more complex word problems (57%). Pre-service teachers related that their students struggle with reading comprehension, understanding word problems, and grasping the cognitive concepts behind negative numbers (76%). There was also an emphasis on more concrete examples, visual aids like manipulatives, and multi-sensory instruction to support learning (76%).

Although the above barriers and suggestions to address them showed that, overall, 100% of PSTs used at least part of the profiles and the lesson plan that was provided within the assignment in their responses, only 57% addressed all parts of the profile and lesson plan objectives in identifying barriers and misconceptions in learning a particular standard. Three pairs of pre-service math and special education PSTs added obstacles for students that were not yet included in the given information are well-known barriers. For example, students said that a barrier to the lesson would be that their students could not find 3-digit numbers on the number line or perform operations with them. Another group of PSTs suggested that timed tests would be complex for students, yet the lesson plan and particular profile did not mention these barriers.

Research Question 2: Selecting Strategies

Content and Instructional Strategies

The results indicated that pre-service teams provided a variety of strategies and interventions designed to support students, particularly those who needed additional help to understand and engage in learning mathematical goals because of a lack of prior knowledge. Each of the 14 pairs provided multiple strategies: 87% were explicitly related to math goals, while 71% involved instructional engagement. Three groups suggested strategies that did not align with the learner profile or mathematical goals of the lesson (e.g., quiet workspaces, when the student enjoyed and worked well with others).

Generic Versus Specific Strategies

A common observation across all 14 pairs of PSTs was that the naming of strategies were generic or specific. Specific strategies directly address students' needs, context, or goals (test-taking accommodations, such as placing students in a more private area and scaffolding the number line process by "walking the line" (physically walking on a floor-sized number line). Generic strategies are broader approaches (e.g., visual aids, scaffolding,

and chunking), which are effective for many students but lack details for students within the profiles. An example of a specifically identified instructional strategy would be, "The plan that would work best for Ethan would be an activity where we put a number line on the floor so that students can move along the number line as we add and subtract numbers. This creates more hands-on participation in the lessons. This also aligns with Ethan's need for concrete examples and simplified instructions supporting active involvement, which will help him to engage with math content while receiving the one-on-one support he needs."

Higher-Order versus Lower-Level Cognitive Demand Strategies

Further analysis of strategies revealed that PSTs used a variety of higher/lower cognitive demand tasks. The authors used the definitions of high and low cognitive demand based on Smith et al.'s (2000) work on classifying tasks. Higher-order cognitive demand tasks require students to analyze, synthesize, and evaluate concepts; apply critical thinking; and create solutions. Examples of PST higher-order cognitive demand strategies include making sense of the operations and being on a number line that goes beyond procedures. Lower cognitive demand strategies help students remember knowledge without requiring deep cognitive engagement. Examples include extended time and simplifications, such as larger texts or repeated problem sets with more straightforward problems.

Of all the strategies listed, only three groups used higher-order strategies, including: "using manipulatives to develop strong algebraic understanding"; " Using chunking and visual aids to see and understand problem-solving by visualizing the problems.". The strategies of six groups were classified as moderate in cognitive demand. That is, they all suggested active learning strategies without formalizing students' understanding. Finally, two groups suggested test modification, text adaptations and time adjustments, although helpful, did not address higher cognitive demands.

Research Question 3: Teachers' Collaboration When Co-planning

Four of the 14 partners worked on all tasks as a team without division of responsibilities. They collaborated through in-person meetings and virtual tools to complete their assignments. Three groups worked on this assignment independently, with minimal online collaboration, by dividing tasks and completing parts separately.. All the groups communicated through text or email and combined their contributions. Seven groups used a hybrid collaboration approach, starting the project in person with meetings or online discussions and dividing the tasks into independent tasks.

Concerning the resources the groups decided to use, ten focused on external resources such as AI tools, academic journals, textbooks, websites, and teaching platforms to provide evidence-based strategies tailored to the IEP needs of their student profiles. Many groups (n=12) also utilized personal

knowledge and experiences from observing mentor teachers, prior teaching experience, and prior knowledge of disabilities from coursework. The two groups relied entirely on previous knowledge and experience without seeking additional information or tools. Tables 2 and 3 compare the role of collaboration and the types of resource PSTs used with how their responses aligned with student profiles and lesson plans.

Table 2
Affiliation Style vs. Alignment with Barriers and Strategies

Collaboration Style	# of Groups	Barriers aligned with Profile and Lesson Plan	Strategies aligned with Profile and Lesson Plans
Together Collaboration	4	4/4 (100%)	4/4 (100%)
Separate Collaboration	3	2/3 (67%)	2/3 (67%)
Combination of Both	7	6/7 (86%)	6/7 (86%)

Table 3
Types of Resources Used in Identifying Barriers and Strategies

Resource Type	# of Groups	Barriers aligned with profile and lesson plan	Resources aligned with profile and lesson plan
External Resources	10	9/10 (90%)	9/10 (90%)
Experiences and Backgrounds	12	9/12 (75%)	8/12 (67%)
No Resources Used	2	1/2 (50%)	1/2 (50%)

When analyzing the above findings, collaboration aided the alignment of barriers, strategies, and resources compared to those who worked separately or with hybrid approaches. Groups that incorporated external resources were more aligned than were those that relied solely on personal knowledge or no resources. Groups that successfully identified barriers and misconceptions (RQ1) were typically the same as those that designed effective strategies aligned with these barriers and misconceptions (RQ2). This alignment suggests that groups with a solid understanding of their students' needs were

consistent across both questions. Addressing RQ1 (identifying barriers/misconceptions) is a prerequisite to answering RQ2 (developing aligned strategies). If a group failed to identify accurate barriers or misconceptions, it was less likely to design strategies that effectively addressed them. These findings emphasize the importance of collaboration and evidence-based planning for the development of effective lesson modifications.

Student Takeaways from the Co-Planning Process

START HERE. The co-planning process provided pre-service teachers with valuable insights into collaboration, communication, and leveraging of diverse expertise. Across all groups, participants highlighted how working together allowed them to share perspectives and better address the needs of students with IEPs. Moreover, 86% of the groups noted that clear communication and a willingness to compromise were crucial for successful collaboration. These groups emphasized the importance of listening to and respecting differing perspectives, setting clear roles, and establishing deadlines to ensure accountability and minimize conflicts. These strategies strengthened the planning process and were essential for future professional practices.

"Co-planning and gathering information from other teachers is important and valuable when planning lessons. We discussed what methods have worked and have not worked in the past. Co-planning is crucial for getting ideas on accommodating their needs and finding innovative methods" (Group 5).

Flexibility and the effective use of technology have emerged as additional themes that enhance collaboration. Many groups (79%) noted that adaptability, considering alternative ideas, or integrating diverse teaching methods contributed to more substantial lesson outcomes. Recognizing and utilizing each member's strengths also ensured that accommodations and strategies were appropriately tailored to the students' needs. Additionally, 71% of the groups reported using technology to facilitate communication and streamline the co-planning process, particularly for groups that faced logistical challenges. Digital tools such as shared documents, messaging apps, and evidence-based resources such as Universal Design for Learning (UDL) guidelines streamlined the co-planning process and informed realistic accommodations.

More than half of the groups emphasized the importance of starting with students' needs as the foundation for planning. This student-centered approach ensures accommodations aligned with IEP goals, while maintaining high expectations and supporting inclusive learning environments. The following quote demonstrates their dedication to inclusive learning environments:

> When accommodating students with special needs, we take the approach that any change we make specifically for a student is made for the entire class. We need to slow down, convey ideas differently, or provide another medium for student feedback. All teachers should use a Universal Design for Learning, and where one student needs accommodation, it can be easier to apply this accommodation for the rest of the class. Not only does this help all students, but it also ensures that no student is outed for having an accommodation. (Student Group #6)

Conclusions

This study aimed to identify the barriers, strategies, and resources that future mathematics and special education teachers could select for a particular student's profile and lesson plan. The results showed that the co-planning process taught pre-service teachers the value of collaboration, communication, and leveraging diverse expertise. These insights emphasize the importance of co-planning between general and special education teachers, particularly when tailoring inclusive and effective lesson plans. By combining their unique strengths, pre-service teachers can address specific student needs while maintaining high standards of academic rigor. The collaborative process allowed for meaningful discussions about barriers, misconceptions, and strategies, ultimately leading to student-centered recommendations that are realistic and achievable within classroom contexts. This study corroborated the results regarding the positive impact of collaboration, especially with external resources (Garet et al., 2001), who argued that collaborative professional development that includes shared planning and using external evidence-based resources results in more effective teaching practices. Additionally, using external resources such as academic journals and organizational websites (CAST) mirrors the practices discussed by Hattie (2009), who emphasized the importance of using data and evidence-based strategies for improving teaching outcomes.

The results also highlight the critical role of evidence-based practices and strategic use of technology and resources in the co-planning process. Groups incorporating external resources and technology reported more success in identifying barriers, aligning strategies, and addressing students' needs. These findings complement the work of Gersten et al. (2009), who stressed the value of evidence-based content strategies, such as visual aids (e.g., color-coded number line graphic organizers), and instructional techniques such as one-on-one support for students with learning disabilities. They emphasized that well-structured interventions, including visual aids, scaffolding, and clear, explicit instructions, are vital for ensuring student success.

Most PSTs in this study acknowledged the importance of early planning and effective time management to ensure ample time for brainstorming, revision, and addressing challenges. Clear and consistent

communication is essential for successful collaboration, and advice to future teachers participating in this assignment is to use a combination of face-to-face meetings, messaging platforms, and shared documents to maintain open lines of communication. These tools enable all group members to contribute their ideas, provide constructive feedback, and avoid misunderstandings that could impede their progress.

Pre-service teachers also learned that they must leverage their peers' expertise and strength. For example, content knowledge from math teachers and expertise in accommodations from special education teachers can complement each other, resulting in more inclusive lesson plans. Incorporating evidence-based practices is another key component, as credible resources such as academic journals, Universal Design for Learning (UDL) guidelines, and proven instructional strategies ensure that lesson modifications are practical and grounded in research. Finally, participants should reflect on their experiences and remain flexible, adapting their approaches as new ideas emerge or challenges arise. These practices will help pre-service teachers develop the skills necessary to collaborate effectively and design equitable and inclusive learning environments that meet the needs of all students.

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