Special education teachers' perspectives of effective pre-service training practices in systematic instruction for students with extensive support needs

Virginia L. Walker[1], Karen Douglas[2], Chuang Wang[3] and Zhi Li[4]

[1]Department of Special Education and Child Development, University of North Carolina at Charlotte, Charlotte, North Carolina, USA; [2] School of Teacher Education and Leadership, Radford University, Radford, Virginia, USA; [3]Faculty of Education, University of Macau, Macau, China; [4]Department of Educational Leadership, University of North Carolina at Charlotte, Charlotte, North Carolina, USA

This survey study examined 164 in-service special education teachers' perceptions of training strategies in their cross categorical teacher preparation program in the United Sates for developing knowledge and skills in systematic instruction, an evidence-based practice for students with extensive support needs. Both classroom-based and field-based training strategies were evaluated along with teachers' perceptions of the contribution and importance of the various training strategies. Results from Chi-square tests, Pearson correlations, multivariate analysis of covariance, and repeated measures of analysis of covariance indicated that teachers felt prepared to implement systematic instruction after exiting their program and after teaching students with disabilities, and the perceived effectiveness of training strategies was related to teacher experience. Teachers perceived modeling and receiving performance feedback in both university classrooms and field-based settings to contribute to their knowledge and skill development in systematic instruction. We present the results in terms of implications for practice and future research.

Keywords: systematic instruction; evidence-based practices; teacher preparation; special education; extensive support needs

In an effort to ensure that students with disabilities receive high-quality instruction that leads to positive student outcomes, there has been a heavy emphasis on identifying and applying evidence-based practices (EBPs) in the field of special education (Cook *et al*. 2009; Spooner *et al*. 2017). EBPs are strategies that have resulted in improved student outcomes as demonstrated through replications of rigorous, high-quality research studies from different groups of researchers (Cook *et al*. 2008, 2009). Given the effectiveness of EBPs, it is imperative that teacher preparation programs teach special education teachers to have an awareness of EBPs and implement them with fidelity (Brownell *et al*. 2010). Specific legislation in the United States emphasizes the importance of special education teachers having knowledge of EBPs and implementing effective practices that are considered evidence-based. The No Child Left Behind Act (2002) mandated teachers to use EBPs and this continues to be emphasized under the Every Student Succeeds Act (2015). The Individuals with Disabilities Education Improvement Act (IDEIA, 2004) does not specifically use the term EBP but includes language emphasizing the importance of selecting interventions based on peer-reviewed research.

Furthermore, the Council for Exceptional Children (CEC), an international professional organization, explicitly calls for special education teachers to use EBPs. Initial Preparation Standard 5.0 calls for beginning special education teachers to be able "to select, adapt, and use a repertoire of evidence-based instructional strategies to advance learning of individuals with exceptionalities" (CEC 2015, p. 5). Although beginning and experienced special education teachers should be prepared to use EBPs, special education teachers do not necessarily make instructional decisions based on whether a practice is considered evidence-based, but rather often rely on their own judgement and individual student needs (e.g. Knight *et al*. 2019). In addition, teachers may have limited knowledge about what constitutes an EBP for certain populations (e.g. Greenway *et al*. 2013). This may result in a

Correspondence to: Virginia Walker, Special Education and Child Development, University of North Carolina at Charlotte, Charlotte, North Carolina, USA. Email: virginia.walker@uncc.edu

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piecemeal approach, whereby teachers select an assortment of practices that may or may not be a good fit for their students. For teachers of students with extensive support needs, the use of EBPs identified for this student population (e.g. systematic instruction) is critical in promoting student success across a wide range of skill areas (Spooner *et al*. 2017).

Systematic instruction

Special education teachers who are prepared to support students with extensive support needs should have knowledge and skills in systematic instruction (Ruppar *et al*. 2018). Systematic instruction is an EBP for teaching students with extensive support needs (Browder *et al*. 2014; Spooner *et al*. 2017) who typically receive special education services under the eligibility categories of intellectual disability, autism, and multiple disabilities and are eligible to participate in the state alternate assessment. Systematic instruction is an instructional method that incorporates the principles of applied behavior analysis to teach specific, measurable responses or behaviors by systematically prompting students and providing feedback (Collins 2022). Specific systematic procedures include response prompting systems such as time delay, system of least prompts, most-to-least prompting, simultaneous prompting, and graduated guidance (Brown *et al*. 2019; Collins 2022), all of which promote correct student responding while fading instructor support as independence is achieved. Oftentimes, cross categorical teacher preparation programs in the United States prepare special education teachers to teach students with a range of disabilities, including students extensive support needs (Ruppar *et al*. 2018). Given that systematic instruction is considered an EBP for students with extensive support needs, cross categorical programs are likely to include content and experiences focused on systematic instruction.

Decades of research evidence point to systematic instruction and response prompting systems that fall under the scope of systematic instruction as being highly effective for students with extensive support needs (Spooner *et al*. 2017). Even expert teachers and faculty members have identified systematic instruction as a necessary skill when instructing students with extensive support needs (Ruppar *et al*. 2015, 2017). Ruppar *et al*. (2018) described how initially pre-service special education teachers should have an awareness of systematic instruction and know how to implement the prescribed strategies with fidelity. By the time pre-service teachers graduate, they should be able to plan, instruct, and collect data using systematic procedures to teach high priority goals. They discussed the stages of expertise development with specific emphasis on systematic instruction for pre- and in-service teachers educating students with extensive support needs. Consequently, as teachers gain more experience, they should become more competent implementers of systematic instruction and be able to train others, including paraprofessionals and family members.

However, evidence suggests that special education teachers often lack the knowledge and skills necessary to use systematic instruction and/or have not received training in systematic instruction prior to entering the workforce. Delano *et al*. (2008) noted that teachers do not always feel prepared to implement EBPs after graduating from their teacher preparation programs, especially when instructing students with extensive support needs. Furthermore, Ruppar *et al*. (2016) suggested that teachers with a cross categorical license may be less prepared to implement systematic instruction as compared to peers with licensure focused on students with more significant needs. Finally, systematic instruction is not always used by special education teachers (e.g. Gee and Gonsier-Gerdin 2018), likely due in part to limited to no systematic instruction training or generalization training in teacher preparation curriculum (Markelz *et al*. 2017).

Training approaches

Pre-service teachers are often taught through didactic approaches, experiential approaches, or a combination of the two approaches. Didactic approaches include lecture-based workshops or classes that are expert centered. Experiential or field experiences provide authentic opportunities for pre-service teachers to link theoretical knowledge to actual implementation of EBPs (Darling-Hammond and Sykes 2003; Nagro and Deettencourt 2017) while receiving feedback. These specific methods of support and feedback assist in developing effective teaching practices (Kretlow and Bartholomew 2010; Sinclair *et al*. 2020). Some studies have even looked at the effectiveness of a combination of the two approaches where growth was shown after didactic and experiential training sessions (e.g. Kretlow *et al*. 2012; Kretlow *et al*. 2011).

In relation to EBPs, research has demonstrated that pre-service special education teachers can be taught to use a range of EBPs. For example, Sayeski *et al*. (2019) examined role-play with performance feedback within the higher education classroom for an EBP. Interestingly, pre-service teachers who received performance feedback outperformed their peers in measures of implementation fidelity. In conducting a literature review, Cornelius and Nagro (2014) found that performance feedback delivered to pre-service special education teachers during field experiences was an EBP. Performance feedback increased implementation fidelity of EBPs for all but one participant across five studies in the review. In terms of training pre-service teachers to implement systematic instruction specifically, O'Reilly *et al*. (1992, 1994) compared the effectiveness of immediate and delayed feedback in a field experience placement with students with extensive

support needs. The results showed that immediate feedback was more effective on pre-service teachers' implementation compared to delayed feedback. More recently, Sawyer *et al*. (2017) evaluated the impact of behavioral skills training on pre-service special education teachers' implementation of constant time delay and system of least prompts, two common response prompting systems. A combination of instructions, modeling, role-play, and feedback resulted in improved performance across all but one pre-service teacher.

Purpose and research questions

It is important to explore different training approaches to prepare future special education teachers to be effective implementers of systematic instruction. Although there is mounting evidence that in-service teachers and paraprofessionals can implement systematic instruction and train others to do so (e.g. Britton *et al.* 2017; Walker *et al.* 2020), few studies have explored pre-service training in systematic instruction (e.g. O'Reilly *et al*. 1992, 1994; Sawyer *et al*. 2017). These studies focused on examining the effectiveness of only a few select training practices, and therefore do not provide important information about how teacher preparation programs are training pre-service teachers in the area of systematic instruction and how such practices are perceived by program graduates. Given the dearth of information related to pre-service training in the area of systematic instruction, this study addressed the following research questions:

1. What are in-service special education teachers' perceptions of preparedness to implement systematic instruction after graduating from their cross categorical teacher preparation program and working as a special education teacher?
2. What strategies and barriers do special education teachers believe supported or hindered their knowledge acquisition and skill development in systematic instruction during their cross categorical teacher preparation program?
3. How do years of teaching and the experience of training others (i.e. paraprofessionals, peers, family members) relate to special education teachers' perceptions of the contribution of training approaches to their knowledge acquisition and skill development in relation to systematic instruction?
4. How do special education teachers' perceptions of the contribution of training approaches received during their cross categorical teacher preparation program relate to their perceptions of the importance of training approaches for pre-service special education teachers in general?
5. Do special education teachers perceive classroom-based approaches or field-based approaches as contributing more to their knowledge acquisition and skill development in relation to systematic instruction during their cross categorical teacher preparation program?

Method

Participants

Given the exploratory nature of the study, we used a convenience sampling approach to survey 510 in-service special education teachers who graduated between 2006 and 2017 from a cross categorical special education teacher preparation program at a mid-sized university located in the midwestern United States. The undergraduate program prepared future teachers to obtain cross categorical licensure in special education; therefore, all participants received coursework and field experiences related to supporting K-12 students with a range of disabilities, as opposed to a specific disability category or group of related disability categories. Starting in 2006, all program participants were required to take a course in systematic instruction related to students with extensive support needs as part of the required course sequence. Although this was their only course in systematic instruction, program participants had opportunities to apply the instructional strategies during a semester-long field experience in a classroom supporting students with extensive support needs. A total of 197 (39% response rate) in-service special education teachers agreed to participate in the survey. However, we excluded 15 teachers who reported graduating from the program before 2006, 13 teachers who failed to answer questions related to the program, and five teachers due to incomplete responses to the survey. As such, the sample used for data analyses consisted of 164 (83.3%) in-service special education teachers who responded to at least one of the survey items related to the program. These teachers were taught by different college instructors with varying degrees of knowledge and experiences related to educating students with extensive support needs.

The participants were predominately female ($n = 157$, 95.7%) with only seven (4.3%) male teachers. Out of the 164 participants, 116 (70.7%) received the survey through email and 48 (29.3%) accessed the survey through an anonymous link posted to social media. Most participants ($n = 138$, 84.1%) graduated from the program between 2014 and 2017, whereas fewer ($n = 26$, 15.9%) graduated between 2006 and 2013. The majority ($n = 134$, 81.7%) reported their most advanced degree as a bachelor's degree. Others reported obtaining a master's degree after graduating from the program ($n = 24$, 14.6%) or failed to report this information ($n = 6$, 3.7%). At the time of the study, 71 (43.3%) were teaching students with extensive support needs and 91 (55.5%) were teaching other students not considered to have extensive support needs. As for the grade level, 55 (33.5%) were teaching in a middle school, 52 (31.7%) were teaching in a high school, 44 (26.8%) were teaching in an elementary school, and four (2.4%) were teaching in an early childhood setting. Nine (5.5%)

teachers did not provide information about their current employment setting. Teachers had a range of experiences in relation to using systematic instruction after graduating from their teacher preparation program (see Table 1). For example, most (70%) implemented systematic instruction after graduation and taught various skills, including academic skills, social/communication skills, life skills, self-determination skills, and physical/motor skills. More than half of the participants (52%) taught in self-contained special education classrooms whereas the rest taught in a resource special education classroom, an inclusive general education classroom, community settings, vocational settings, and other non-inclusive settings. Of those who provided training to others, most provided training to paraprofessionals. A majority of participants felt somewhat prepared or quite a bit prepared to implement systematic instruction after the program (79%) and after teaching (74%).

Survey instrument

We designed the survey to examine in-service special education teachers' perceptions of effective pre-service training strategies for developing knowledge and skills in systematic instruction for students with extensive support needs. Survey content was based on systematic instruction textbooks (e.g. Collins 2022) and research focused on educator training practices (e.g. Brock and Carter 2017). The survey instrument underwent two levels of review and revision before being distributed to teachers. First, four experts in systematic instruction and one expert in survey design reviewed the survey to identify potential issues with survey content and design, respectively. Second, three graduates from the program participated in a cognitive interview using a think-aloud approach, which involved expressing the processes through which their responses were selected (Willis 2015). We revised the survey instrument based on both levels of review, which included expanding response options (e.g. adding additional settings in which systematic instruction could be delivered), further defining systematic instruction, and adding clarifying language (e.g. clarifying meaning of knowledge acquisition and skill development). The final survey instrument (available upon request from first author) consisted of 49 items organized across the following four categories:

Special education teacher descriptive information

Items under the first category included the teacher's gender, age, graduation year, highest level of education, focus of graduate degree, years working as a special education teacher, state in which teacher was employed, grade levels served, disabilities categories representing current students, and whether the teacher taught students with extensive support needs at the time of the study. We defined extensive support needs as students receiving special education services under the eligibility categories of multiple disabilities, autism, or intellectual disability who qualify for the state alternate assessment.

Systematic instruction experience

Items under the second category included whether the teacher implemented systematic instruction with current students (i.e. yes, no, unsure), skills taught using systematic instruction (i.e. academic, life, self-determination, social/communication, physical/motor), settings in which the teacher implemented systematic instruction (e.g. inclusive general education classroom where students worked alongside other students without disabilities, separate special education resource or self-contained classroom where students worked alongside other students with disabilities), whether (i.e. yes, no, unsure) and how the teacher trained others (i.e. paraprofessionals, peers, family members) to implement systematic instruction, and perceived extent of preparedness to implement systematic instruction after graduating from the teacher preparation program and after teaching for several years (i.e. not at all prepared, somewhat prepared, quite a bit prepared, completely prepared). We defined systematic instruction as a plan of specific prompting and feedback methods to teach an observable, measurable behavior, involving response prompting systems and a plan for delivering reinforcement and error correction in a systematic manner (Brown *et al*. 2019; Collins 2022).

Teacher preparation training approaches

Under the third category, teachers reported the extent to which classroom-based and field-based training approaches contributed to knowledge acquisition and skill development in systematic instruction during their teacher preparation program (see Table 3 for specific training approaches). We defined knowledge acquisition as *learning* concepts related to systematic instruction and skill development as *applying* concepts to implement systematic instruction. For each training approach, respondents rated the level of contribution using a Likert-type scale (1 = *negative contribution*, 4 = *strong positive contribution*) or selected "not applicable" due to the specific approach not being implemented within their program.

Classroom-based training approaches were those delivered during class time. Responses to the nine items to measure teacher perceptions of the contribution of classroom-based training approaches to knowledge acquisition were reliable as the internal consistency measured by Cronbach's alpha was satisfactory (α = .84). Responses to the nine items to measure teacher perceptions of the contribution of classroom-based training approaches to skill development were also reliable (α = .86). Field-based training approaches were those delivered in relation to implementation of systematic instruction by the pre-service teacher in applied,

field-based settings. Responses to the five items to measure teacher perceptions of the contribution of field-based training strategies to their own knowledge acquisition were reliable ($\alpha = .86$). Responses to the five items to measure teacher perceptions of the contribution of field-based training strategies to their skill development were also reliable ($\alpha = .82$). In addition, we included two open-ended items that prompted respondents to identify specific strategies and barriers to knowledge acquisition and skill development in systematic instruction they had experienced during their teacher preparation program.

Importance of training approaches

Finally, under the fourth category, teachers indicated the level of importance of including classroom-based and field-based training approaches in teacher preparation programs to facilitate knowledge acquisition and skill development in relation to systematic instruction. For each training approach (see Table 3 for specific training approaches), respondents rated the level of importance using a Likert-type scale (1 = *no importance*, 6 = *extreme importance*). Responses to the nine items to measure teacher perceptions of the importance of classroom-based training strategies to teachers' knowledge acquisition and skill development in relation to systematic instruction were reliable ($\alpha = .79$). Responses to the five items to measure teacher perceptions of the importance of field-based training strategies in relation to knowledge acquisition and skill development were also reliable ($\alpha = .82$).

Survey dissemination

The survey instrument was available via Qualtrics, a secure survey development platform. Prior to distribution, we obtained a list of 795 graduates who graduated from the program between 2006-2017. We identified the email addresses for 510 of the participants that were on file at the university or provided on school websites but were unable to do so for the remaining 285 whose email addresses were not on file or publicly available. As such, we also distributed the survey by sharing the survey link through two social media accounts (Facebook and Twitter) affiliated with the program in an effort to reach all graduates. For email distribution, we sent a survey invitation containing a link to the Qualtrics survey followed by a 1-week and 1-month follow up invitation. For social media distribution, we posted an advertisement containing a link to the survey one time on each account. To increase responding, we incentivized participation by offering 10 randomly-selected participants with a gift bag containing various program- and university-affiliated items (e.g. t-shirts, pens, notebooks with university logos).

Data analysis

We used descriptive statistics to report participant responses to survey items. To answer Research Question 1, we employed Chi-square tests to examine differences in participants' level of preparedness to implement systematic instruction after graduation from their teacher preparation program and after teaching. The Chi-square test is often used to test differences in the distribution of frequencies (Coladarci *et al*. 2014). We used this to determine whether experience in teaching would change their perception of preparedness. For open-ended items, we coded participants' responses with an open-coding approach (i.e. the coding process was not restricted to any predetermined categories; Bazeley and Jackson 2013; Creswell 2007). First, qualitative data were reduced to various descriptive categories. Then, relationships between initial nodes were identified. Higher-order themes were generated from lower-order nodes. To illustrate each theme, we used quotes from the participants to explain the strategies and barriers participants reported. Frequencies of each theme were also reported to show the distribution of identified themes from responses to open-ended questions.

We reported bi-variate Pearson correlation coefficients to answer the first part of Research Question 3 and Research Question 4 as this method examines the percentage of covariance relative to the variance of each of the two continuous variables. In other words, Pearson correlation coefficients represents how much the two variables change together relative to how much each variable changes itself (Coladarci *et al*. 2014). Further, we used multivariate analysis of covariance (MANCOVA) to examine differences in teacher perceptions of the contribution of training approaches to their knowledge acquisition and skill development in relation to systematic instruction between teachers who had trained paraprofessionals to use systematic instruction and those who had not (second part of Research Question 3). We used MANCOVA as there was more than one dependent variable and our aim was to examine differences between two groups of teachers (i.e. those who had trained paraprofessionals and those who had not) in the two dependent continuous variables (i.e. teacher perceptions of the contribution of training approaches to their knowledge acquisition and skill development) while controlling for the number of years after graduation (covariate). MANCOVA is the commonly used statistical procedure to examine between-group differences in more than one continuous variable while controlling for other variable(s) that might also be related to the dependent variables (Tabachnick and Fidell 2019). We used the number of years after graduation as a covariate to control for the differences

between programs across years as well as possible changes of teacher perceptions across years.

To answer Research Question 5, we tested differences in teacher perceptions in classroom-based and field-based approaches with three-way repeated measures analysis of covariance (ANCOVA) with three independent variables (i.e. school level, implementation of systematic instruction status, whether or not the teacher had taught students with extensive support needs) and a covariate (i.e. number of years after graduation). Finally, we determined effect size using Cohen's (1988) criteria for partial eta squared: 0.01 (small); 0.06 (medium); and 0.14 (large).

Results

Research question 1

Participants' responses to survey questions about their perceptions of preparedness to implement systematic instruction after graduating from their teacher preparation program and after working with students with disabilities for at least one year are presented in Table 1. Overall, the majority of the participants reported implementing systematic instruction after graduation, teaching a wide range of skills primarily in self-contained special education classrooms or resource special education classrooms. Less than half of the teachers reported training others to use systematic instruction, with these efforts largely focused on supporting paraprofessionals to utilize systematic instruction. As shown in Table 1, only two participants reported "not at all prepared" after the program and seven participants reported "not at all prepared" after teaching. As for teachers' perceptions of preparedness after program, 50 (31%) reported "somewhat prepared," 79 (48%) reported "quite a bit prepared," and 33 (20%) reported "completely prepared." As for teachers' perceptions of preparedness after teaching, 42 (26%) reported "somewhat prepared," 79 (48%) reported "quite a bit prepared," and 35 (21%) reported "completely prepared."

Because the responses to "not at all prepared" were very small in number, these responses were removed from the follow-up Chi-square test. The Chi-square test showed a statistically significant difference in the participants' responses to their levels of preparedness to implement systematic instruction after graduation and after working as a special education teacher, χ^2 (*4*, $N = 155$) $= 65.25$, $p < .001$. Although the number of responses to each level is about the same, many participants changed their perception of preparedness to implement systematic instruction after working as a special education teacher for a few years. Slightly more teachers felt "not at all prepared" after working as a special education teacher for a few years in comparison to right after graduation from the program.

Research question 2

Participants identified more strategies they believed supported their knowledge acquisition and skill development in systematic instruction during their teacher preparation program than barriers that hindered this

Table 1. Descriptive statistics about systematic instruction implementation ($N = 164$)

Survey item	Number	Percentage
Implementation of systematic instruction		
Yes	114	70
No	46	28
Unsure	4	2
Skills taught		
Academic skills	82	50
Social/communication skills	80	49
Life skills	70	43
Self-determination skills	66	40
Physical/motor skills	26	16
Settings		
Self-contained special education classroom	86	52
Resource special education classroom	37	23
Inclusive general education classroom	25	15
Community settings	28	17
Vocational settings	16	10
Other non-inclusive settings	13	8
Other	4	2
Training		
Paraprofessional	56	34
Family member	6	4
Peer	5	3
Preparedness after program		
Not at all prepared	2	1
Somewhat prepared	50	31
Quite a bit prepared	79	48
Completely prepared	33	20
Preparedness after teaching		
Not at all prepared	7	4
Somewhat prepared	42	26
Quite a bit prepared	79	48
Completely prepared	35	21

process. Specifically, among the 97 participants who identified supportive strategies, 60 (62%) participants identified the following practices as being helpful: application activities in both applied settings and the university classroom, role-play, group activities with classmates, student teaching experience, task analysis practice, and case study activities. One participant wrote that "… hands on practice both inside the classroom at [the university] with other classmates and then real-life application with students with disabilities" contributed to knowledge and skill development. In addition, 41 (42%) participants viewed video application assignments as one of the most helpful strategies, which included watching video-recorded demonstrations of systematic instruction delivery, creating video demonstrations, and video modeling. For example, one participant wrote, "Watching videos in class was also extremely helpful because we were able to see what a great example could look like." Participants mentioned other strategies as being helpful. For instance, 23 (24%) pointed out modeling as a helpful strategy, 19 (20%) discussed the use of different types of examples in the class, and 17 (18%) thought instructor and peer feedback was useful. It is worth mentioning that only two of all the participants (2%) felt there were no helpful strategies when they learned systematic instruction in their program. One participant wrote, "Modeling, videos, and case studies helped the most to see how these skills are used in the classroom." Another participant added, "One specific strategy used was using real life examples to enhance our understanding of the material taught."

Although participants identified many strategies that were helpful, 88 participants mentioned experiencing barriers. Twenty-seven participants (28%) considered their instructor not fully qualified and expressed concerns related to the course design and classroom activities. For example, one participant mentioned that "Being forced to collaborate with peers whose knowledge was significantly below expectations was frustrating and did not contribute to my knowledge." Moreover, 24 (25%) participants pointed out that it was hard for them to locate students with extensive support needs who were in need of systematic instruction. Another primary barrier that participants identified was real-world application, with 22 (23%) participants reporting that it was difficult to apply systematic instruction in real world settings and did not have many opportunities to use systematic instruction. Thirteen (13%) of all the participants reported no barriers to knowledge development and skill development during the teacher preparation program.

Research question 3

A negative relationship was noted between the years of teaching students with disabilities and the teachers' perceptions of the contribution of training approaches to their knowledge acquisition ($r = -.25$, $p < .01$) and skill development ($r = -.24$, $p < .05$) in relation to systematic instruction. These negative relationships suggest that, as years of experience increased, teacher perceptions of the contribution of the training approaches decreased.

There were only five teachers who had trained a peer tutor and six teachers who had trained a students' family member to implement systematic instruction. Therefore, only the differences between teachers who had trained a paraprofessional to implement systematic instruction with respect to their perceptions of the contribution of training approaches to their knowledge acquisition and skill development were examined with MANCOVA. Results showed statistically significant differences in teacher perceptions of the classroom-based training approaches to their knowledge acquisition and skill development but not in their field-based training approaches. Specifically, teachers who had not trained paraprofessionals ($M = 3.46$; $SD = 0.38$) viewed the contribution of classroom-based approaches to their knowledge acquisition more positively than those who had trained paraprofessionals ($M = 3.25$; $SD = 0.41$), F (1, 84) = 5.83, $p < .01$, partial $\eta^2 = .07$ (medium effect size). Similarly, teachers who had not trained paraprofessionals ($M = 3.41$; $SD = 0.42$) viewed the contribution of classroom-based approaches to their skill development more positively than those who had trained paraprofessionals ($M = 3.15$; $SD = 0.39$), F (1, 84) = 8.06, $p < .01$, partial $\eta^2 = .09$ (medium effect size). No statistically significant differences were noted between these two groups of teachers with respect to their perception of the contribution of field-based approaches to their knowledge acquisition or skill development ($p > .05$).

Research question 4

A statistically significant positive relationship was noted between teachers' perception of the contributions of training approaches received during their teacher preparation program and their perceptions of the importance of training approaches for pre-service special education teachers in general (Table 2).

Table 2. Correlation coefficients of relationships between perceptions of contribution and importance

	2	3	4	5	6
Knowledge Classroom-based (1)	.54**	.89**	.58**	.43**	.22*
Knowledge Field-based (2)		.57**	.87**	.34**	.40**
Skill Classroom-based (3)			.56**	.46**	.21
Skill Field-based (4)				.32**	.31**
Importance Classroom-based (5)					.65**
Importance Field-based (6)					

Note. Sample sizes varied from 88 to 132 for bi-variate correlations.
*$p < .05$.
**$p < .01$.

Table 3. Descriptive statistics of teacher perception of the contribution of classroom-based and field-based training approaches to their knowledge acquisition and skill development

	Knowledge		*Skill*	
Training strategy	*M*	*SD*	*M*	*SD*
Classroom-Based				
Model or demonstration of systematic instruction	3.58	0.55	3.52	0.56
Feedback/reflections	3.46	0.60	3.45	0.62
Role play between students	3.47	0.64	3.51	0.64
Video demonstration of systematic instruction	3.44	0.60	3.44	0.62
Group discussion with students	3.45	0.55	3.29	0.56
Homework assignments	3.25	0.68	3.20	0.68
Case studies	3.32	0.60	3.12	0.67
Game/simulation	3.09	0.75	3.01	0.75
Written resources provided by instructor	3.25	0.58	3.20	0.56
Field-Based				
Model or demonstration of systematic instruction in applied setting	3.49	0.59	3.55	0.57
Feedback on student implementation in applied setting	3.44	0.65	3.46	0.63
Live observations of student implementation in applied setting	3.36	0.69	3.36	0.69
Role play in applied setting	3.41	0.64	3.50	0.63
Video recording student implementation in applied setting	3.31	0.66	3.35	0.61

Note. Sample sizes varied from 88 to 132 due to missing data for each item. Response scale: 1 = negative contribution, 2 = no contribution, 3 = positive contribution, 4 = strong contribution.

Table 4. Descriptive statistics of teacher perception of the contribution of classroom-based and field-based training approaches to their knowledge acquisition and skill development based on implementation, student population, and school level (*N* = 100).

	Knowledge				Skill			
	Classroom-Based		Field-Based		Classroom-Based		Field-Based	
Groups	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Implemented SI ($n = 73$)	3.36	0.42	3.44	0.53	3.33	0.43	3.50	0.47
Not Implemented SI ($n = 27$)	3.41	0.41	3.30	0.50	3.32	0.39	3.32	0.46
Teaches Students with Extensive Support Needs ($n = 54$)	3.36	0.43	3.39	0.56	3.30	0.40	3.42	0.48
Does Not Teach Students with Extensive Support Needs ($n = 46$)	3.39	0.40	3.42	0.48	3.35	0.44	3.48	0.46
Elementary School ($n = 28$)	3.31	0.50	3.15	0.55	3.19	0.44	3.31	0.45
Middle School ($n = 37$)	3.39	0.38	3.48	0.52	3.32	0.40	3.46	0.52
High School ($n = 35$)	3.42	0.39	3.52	0.44	3.43	0.40	3.54	0.41

Note. SI = Systematic Instruction. Response scale: 1 = negative contribution, 2 = no contribution, 3 = positive contribution, 4 = strong contribution.

Research question 5

Descriptive statistics of teachers' perceptions of the contribution of classroom-based and field-based training approaches to their knowledge acquisition and skill development are presented in Table 3. These data suggest that in-service special education teachers ranked modeling or demonstration of systematic instruction and feedback as the top two approaches that contributed to their knowledge acquisition and skill development in both classroom-based training and field-based training. Table 4 provides more detailed descriptive statistics of teacher perceptions of the contribution of classroom-based and field-based training approaches to their knowledge acquisition and skill development by teachers' experience (i.e. whether or not they had implemented systematic instruction, whether or not they had taught students with extensive support needs) as well as the school context (i.e. elementary, middle, high).

Analyses of teacher perceptions by teachers' experience and the school context were conducted by ANCOVA. Results of the three-way repeated measures ANCOVA showed no statistically significant four-way or three-way interactions and most of the two-way interactions ($p > .05$). However, the interaction effect between whether the teacher had implemented systematic instruction and their perception of the contribution of classroom-based and field-based training approaches to their knowledge acquisition was statistically significant, $F\ (1,\ 87) = 6.38$, $p < .05$, partial $\eta^2 = .06$ (medium effect size). Examination of the interaction effects suggested that teachers who had implemented systematic instruction viewed field-based training contributed more to their knowledge acquisition than teachers who had not implemented systematic instruction at the time of the study. Interestingly, teachers who had not implemented systematic instruction yet viewed classroom-based training approaches as contributing more to their knowledge acquisition.

Exactly the same results came from three-way repeated measured ANCOVA with skill development as the dependent variable. The only statistically significant effect was the interaction between whether the teacher had implemented systematic instruction and their perception of the contribution of classroom-based and field-based training approaches to their skill

development, F (1, 68) = 4.49, $p < .05$, partial $\eta^2 = .07$ (medium effect size). Teachers who had implemented systematic instruction viewed field-based training contributed more to their skill development than teachers who had not implemented systematic instruction at the time of the study. Interestingly, teachers who had not implemented systematic instruction yet viewed classroom-based training approaches as contributing more to their skill development.

Discussion

The purpose of this survey study was twofold. First, we designed the survey to determine whether in-service special education teachers felt prepared to implement systematic instruction after graduating from a cross categorical special education teacher preparation program from one mid-size university in the Midwest of the United States. Second, we examined their perceptions of the contribution and importance of various training strategies used in their teacher preparation program in acquiring knowledge and developing skills in systematic instruction. Given the importance of special education teacher preparation in EBPs (Browder *et al*. 2014; CEC 2015), a closer examination of training strategies applied in teacher preparation programs is necessary to understand how pre-service special education teachers can be better prepared for their future roles as special education teachers. The findings from our study contribute to the existing literature in several ways, as few studies have focused on pre-service teacher preparation in the area of systematic instruction (e.g. O'Reilly *et al*. 1992, 1994; Sawyer *et al*. 2017), a well-established EBP for students with extensive support needs (Browder *et al*. 2014). In the section that follows, we highlight several key findings that extend our current understanding of cross categorical teacher preparation in this particular area.

We found that a majority of in-service teachers implemented systematic instruction to teach a variety of skills (e.g. academic, social/communication, life skills) after graduating from their cross categorical teacher preparation program. Almost all of the teachers indicated that they were prepared to implement systematic instruction after exiting their program and after teaching students with disabilities for at least one year. Interestingly, these findings are in contrast to previous research that suggests special education teachers do not always use effective instructional practices such as systematic instruction to support students with disabilities (Gee and Gonsier-Gerdin 2018) and may not be adequately prepared to do so (Delano *et al*. 2008; Ruppar *et al*. 2016). However, our findings also indicate that teachers felt less prepared to use systematic instruction in their classrooms after teaching for a few years, which might be attributed to issues with knowledge and skill retention due to limited practice in implementing systematic instruction post-graduation. It is also possible that, as teachers gain more experience in teaching and meeting new on-the-job challenges, they may feel that there is something more they could have learned in their teacher preparation program pertaining to systematic instruction. This result is not surprising, as pre-service teachers usually feel that they have learned enough at graduation, as they are unable to predict what they might face as novice teachers in schools (Qadhi *et al*. 2020). Other considerations that may have impacted the results include how the course could have improved over time and how different instructors taught the course.

Teachers identified several classroom-based and field-based strategies that supported their knowledge acquisition and skill development in systematic instruction during their cross categorical teacher preparation experience. These included watching video models of systematic instructional procedures in class, receiving performance feedback on systematic instruction demonstrations, reviewing case studies, and implementing systematic instruction in schools. This outcome supports the notion that training strategies involving modeling and performance feedback might play an important role in improving teachers' implementation of systematic instruction (e.g. McLeod 2020; O'Reilly *et al*. 1992, 1994; Sawyer *et al*. 2017) and emphasizes the value of applying content knowledge and receiving feedback from supervising teachers and course instructors in authentic, field-based settings (Brownell *et al*., 2005; Darling-Hammond and Sykes 2003). The primary barriers noted by respondents related to the course instructor's qualifications and/or organization of the course and challenges in securing opportunities to implement systematic instruction in field-based placements for application-based activities. Again, these responses seem to indicate that experiential training in authentic, school settings might play an important role in promoting successful implementation of systematic instruction.

We also found that teachers' experiences influenced perceptions of knowledge acquisition and skill development. For example, teachers with more years of teaching experience reported lower contribution levels for pre-service training strategies, whereas teachers with fewer years of teaching experience viewed these strategies more favorably. As noted earlier, it is likely that, as teachers spend more time in the field, they become aware of aspects of systematic instruction preparation that were missing from their preparation programs. In addition, teachers who had experience training others to implement systematic instruction, as compared to those who had not trained others, viewed class-based strategies as contributing less significantly to their knowledge and skill acquisition, but there were no differences in perceptions of field-based experiences based on training experience. It is possible that these teachers were

exposed to content specific to techniques for supporting paraprofessionals in the university classroom but did not have experience in training paraprofessionals in field-based settings. Therefore, their real-world experience after graduation potentially provided meaningful opportunities to train others, an important aspect of teacher growth and development in systematic instruction (Ruppar *et al*. 2018). Finally, our findings suggest that teachers who have implemented systematic instruction after graduating from their teacher preparation program viewed field-based strategies as having a higher contribution to knowledge and skill development. This finding adds further support to the benefits of providing opportunities for skill application in field-based settings, where pre-service teachers work directly with students with extensive support needs.

Implications for practice

Systematic instruction has been identified as a critical instructional practice for teachers of students with extensive support needs (Ruppar *et al*. 2015, 2017). Novice special education teachers should be able to plan and implement a range of systematic instructional practices, and as they gain more experience, develop more advanced skills, demonstrate proficiency, and train others who support students with extensive support needs (e.g. paraprofessionals, family members; Ruppar *et al*. 2018). As such, cross categorical teacher preparation programs should strategically and purposefully design programs that include content specific to systematic instruction as well as meaningful field-based experiences in which pre-service teachers have an opportunity to implement systematic instruction and receive ongoing feedback.

The majority of our findings point to teacher experience as a critical factor in how the contribution of different training practices are viewed and the extent to which teachers feel prepared to implement systematic instruction. Although classroom-based strategies in college courses are important in building the foundation for knowledge and skill development, real world experience in authentic settings will help prepare pre-service teachers for the classroom (Markelz *et al*. 2017). In our study, teachers identified limited access to students with extensive support needs in field-based settings as a significant barrier. These issues likely were attributed to logistical challenges (e.g. identifying willing and qualified supervising teachers educating students with extensive support needs) and the limited number of placement options serving students with extensive support needs. Ruppar *et al*. (2016) reported that in-service teachers from cross categorical programs in the United States felt less prepared to implement systematic instruction compared to peers from specialized programs focusing on students with extensive support needs, possibly due to exposure to a wide range of content in cross categorical programs and limited experiences related to students from this population. Teacher preparation programs preparing cross categorical teachers should ensure that their teacher candidates have experience directly working with students with extensive support needs through creative scheduling (e.g. shorter placements), earlier field-based experiences, or home-based or after school tutoring programs.

Relatedly, another important consideration in the development of meaningful opportunities for systematic instruction skill and knowledge development is generalization programming (Markelz *et al*. 2017), as in-service teachers may not be able to generalize skills from the university classroom to the natural school-based setting. Markelz *et al*. (2017) reported that programming for generalization is often absent from special education teacher preparation programs and called for programs to address these concerns by (a) offering professional development on generalization strategies to faculty and staff, (b) identifying methods for developing more cohesive programs where coursework and field experiences are better aligned, and (c) promoting communication among course instructors and supervisors during field-based experiences. If content on systematic instruction is embedded meaningfully throughout coursework and field experiences, opportunities for pre-service teachers to become experienced in implementing systematic instruction for students with extensive support needs may expand.

Limitations and future research

There are two limitations of this study that need to be considered. First, the convenience sample of respondents who graduated from the same special education teacher preparation program in the United States limits the extent to which the results can be generalized to the larger special education teacher population in the United States and internationally. The small sample size also limited the use of statistical procedures for data analyses due to the concern of statistical power. With a larger sample and more balanced design, structural equation modeling could be adopted to examine moderating effects of the experience of implementing systematic instruction on the relationship between teacher perceptions after graduating from the program and years after teaching students with extensive support needs. Additional research is necessary to explore perceptions from a larger, more diverse sample of current special education teachers who received teacher preparation at different universities. We suspect that teachers graduating from programs focused on specialized training in extensive support needs will have different experiences (e.g. Ruppar *et al*. 2016) that will contribute to our overall understanding of effective pre-service training practices in systematic instruction. In addition, teachers in this study had only one course in systematic instruction, a program characteristic that might differ from other cross categorical teacher preparation programs. It is possible

that teachers who have greater exposure to systematic instruction during college will have different perspectives about effective training strategies.

Second, the findings from this study are based on self-reports and reflect teacher perceptions, with some teachers reflecting on their teacher preparation experiences years after graduating from the program. It is possible that teachers' perceptions do not reflect what has actually taken place (e.g. teacher reporting feeling prepared to implement systematic instruction but is unable to implement prompting systems with fidelity). As such, these findings must be interpreted with caution, as we were unable to confirm whether responses accurately reflected actual practices. This points to the importance of future work exploring how well novice teachers implement systematic instruction after exiting their teacher preparation programs, as this would indicate whether training strategies adequately prepared teachers for this responsibility.

Conclusion

Cross categorical special education teachers must be well-versed in implementing many EBPs including systematic instruction. Not only do they need to implement systematic instruction with fidelity but they must also be able to train classroom staff and family members. This knowledge and skill in systematic instruction comes from teacher preparation programs maximizing instructional and practice time with engaging classroom activities and corresponding field-based placements. Increasing the opportunities to implement systematic instruction with students with extensive support needs and receive performance feedback from expert teachers, university supervisors, and course instructors may enhance the preparation of teachers, though additional research is needed to understand the various factors that contribute to effective training strategies across different teacher preparation programs.

Disclosure statement

No potential conflict of interest was reported by the authors.

ORCID

Virginia L. Walker http://orcid.org/0000-0003-3248-7290
Chuang Wang http://orcid.org/0000-0003-3372-2053
Zhi Li http://orcid.org/0000-0002-5037-3580

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