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Quality and Utility of the Multi-tiered Instruction Self-efficacy Scale

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Abstract

Response to Intervention (RTI) is an educational approach that integrates ongoing assessment of individual student progress with targeted instruction.   Administrators and teachers in P-12 schools expressed a need for colleagues in higher education to provide training to general education pre-service and in-service teachers in selecting appropriate instruments and conducting accurate assessments, tasks traditionally performed by special education teachers. Researchers developed a scale to measure self-efficacy of educators using these approaches to better identify areas in which educators need additional support. Researchers wanted to know if the scale functioned as expected and if it was appropriate to use the scale for their intended purposes. This paper describes the results of the study of the characteristics of the scale following the administration of the pilot, including indices of score reliability and utility. The researchers used measures of internal consistency and factor analysis to assess scale quality. The results indicate that the scale is useful for measuring teacher perceptions of their self-efficacy using multi-tiered instructional approaches.

QUALITY AND UTILITY OF THE MULTI-TIERED INSTRUCTION SELF-EFFICACY SCALE

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When asked to describe the education system in the United States, one of the first issues that respondents address is that there is not one, unified system. A typical description would start with clarifying that there are separate systems for P-12 schools and postsecondary education.

Some states are working toward integrating these systems, with the goals to reduce resulting disjuncture and improve instruction (Minnesota, 2002). At the heart of improved instruction, at any level, is teacher quality. A key link between the systems of higher education and P-12 is found in teacher education programs, particularly in the area of assessment. Assessment issues in P-12 and post-secondary systems are similar. Practitioners in both systems collect and use performance data to inform accountability systems and to improve instruction. Efficiently planning to meet the instructional needs of in-service teachers, known as professional development, of pre-service teachers in teacher preparation programs, and of P-12 students requires the same thoughtful processes – assessing the learners' needs, planning and implementing the appropriate intervention, evaluating the effectiveness of that intervention, and making revisions in subsequent instruction based on the outcomes. In public schools, that process is known as Response to Intervention (RTI).

RTI is a 2004 federal public education regulation requiring educational practices designed to narrow achievement gaps and meet the needs of all students (Individuals with Disabilities Education Act of 2004). Data concerning a child's response to instruction and interventions can be used to guide

instructional and behavioral decisions and even eligibility for special education services. Implementation of RTI practices requires more than "tweaking existing assessment practices" but instead necessitates systems change (Burns & Ysseldyke, 2005).

While the 2004 regulations do not mandate a multi-tiered instructional model, RTI practices do not work without implementation within a multi-tiered instructional model (MTI). In an MTI model, educators design instruction with well-integrated content, goals, evidence-based instructional practices and assessment practices for best benefit to most learners in the general education setting. When students struggle with core instruction, educators reteach content to appeal to varied learning styles or to fill learning gaps. When students do not respond to reteaching, educators intervene with tiered interventions at varied levels of intensity, first providing strategic interventions in small groups and when necessary providing intense interventions in very small groups or individualized to meet the unique needs of learners. MTI is a system involving collaborative partner-ships between classroom teachers, specialists and administrators.

Among other practices, MTI stresses evidence-based practices and data-driven decision-making (Barnes & Harlacher, 2008). Some practices are not so new, such as collaboration, though MTI pushes collaboration to new levels. With an emphasis in early interventions to address struggles before gaps reach serious levels, specialists may play proactive roles in core instruction, interventions, or assessment structures. Other MTI principles may feel new to some teachers such as data-driven decision-making, and implementing tiered interventions to meet individual needs.

Public schools requested support in providing professional development for RTI and MTI practices. Those requests were non-specific. In order to design appropriate professional development, the researchers started with a needs assessment. They reviewed literature to determine core content knowledge and skills used in RTI and MTI approaches and to find assessment instruments to measure needs for training in those areas. Various checklists exist to evaluate school or district-level implementation of a multi-tiered intervention methods or RTI practices such as Florida's Self-assessment of Problem-solving Implementation (SAPSI) or Kansas' Innovation Configuration Matrix (Florida Problem-Solving/Response to Intervention Project, 2008; Kansas State Department of Education, 2009). Each of these checklists works as a tool for schools or districts to evaluate systematic levels of progress toward or implementation of various practices such as assessment practices. At the beginning of this project, a review of available scales determined that no one scale or combination of scales effectively assessed self-efficacy in the unique components of MTI practices.

During the time of this study, Florida published the Perception of RTI Skills Survey, a self-rating scale used by teachers to evaluate skills specific to RTI practices such as hypothesizing reasons for gaps and determining appropriate interventions (Florida Problem-Solving/Response to Intervention Project, 2008). Nunn and Jantz (2009) recently demonstrated that the Teacher Efficacy Beliefs and Behavior Scale (TEBBS; 1998) scores have validity for measuring general teacher self-efficacy. Nunn, Jantz and Butikofer (2009) further demonstrated that the TEBBS positively correlated with one measure of student outcomes, the Indicators of RTI Effectiveness Scale (Nunn, 1999).

While the impetus of this study was to assess professional development needs for in-service educators, this study provided valuable applications for teacher education pro-grams. Pre-service educators must be prepared to enter their profession fully equipped to meet the varied demands of MTI

practices. Therefore, the research focus on professional development needs of in-service teachers provided important insight for teacher education program development.

The instrument developed and piloted through this study, the Multi-tiered Instruction Self-Efficacy Scale (MTISES), specifically assesses teacher self-efficacy for MTI practices using a survey taking approximately ten minutes to complete. Because the first version, the Response to Intervention Self-efficacy Scale (RTISES), was a new instrument, the researchers wanted to know if the scale functioned as expected and if it was appropriate to use the scale for their intended purposes.

Research Questions

1)   Does the scale measure one broad construct or several more specific constructs that can be used to characterize self-efficacy using MTI approaches?

2)   What are the meanings of the factors that account for the variation among the set of items?

3)   How can the scale be used for planning professional development in using MTI approaches?

This report addresses these questions using several methods, including descriptive and factor analyses.

Participants

Participants in the scale development process included educators from two school districts, teacher education faculty, and university psychometric experts. Psychometric experts included doctoral students in an assessment and measurement program and one university professor in educational psychology assessment. The teacher educators came from departments of special education and of general early and elementary education. Both school districts are rural with farming communities and small towns. One of those districts served as an MTI pilot district, fully engaged in implementation of MTI practices. The second school district was in early stages of RTI planning. Participants in the pilot of the instrument included educators from three school districts, two fully engaged in MTI implementation. The 184 survey respondents included teachers, specialists, and administrators.

Instrument Development

In order to develop a scale with practical and accurate value for educators and professional development trainers, researchers followed the DeVillis scale development process (2003). That process follows eight steps: (1) decide what to measure, (2) generate item pool, (3) format the measurement, (4) have item pool reviewed by experts, (5) consider validation items, (6) administer items to a developmental sample, (7) evaluate items and scale quality, and (8) determine optimal scale length.

Determining Constructs and Items

The growing body of literature on RTI and MTI-related issues guided the content for the first two steps, focusing on five core constructs. These constructs represent emerging MTI practices, the areas in which teachers would most likely need to revise familiar methods used for assessment and instruction within their classrooms. The researchers identified those five constructs as universal design for learning, proficiency in judging evidence-based practices, collaboration, data-driven decision-making, and implementation of interventions. Universal design for learning (UDL) emphasizes proactive instructional design to address needs of all learners in varied presentation of material, multiple ways to engage with learning, and multiple expressions of learning. UDL respects varied learning styles, ability levels and/or

language competencies (Strangeman, Hitchcock, Hall, & Meo, 2006). Proficiency in judging evidence-based practices includes the need to find what practices are research-based, to judge appropriateness for populations and purposes, and to evaluate effectiveness based upon the research (Barnes & Harlacher, 2008). MTI may change the degree of collaboration (Burnes & Coolong-Chaffin, 2006; Leaving No Child Behind, 2007). Data-driven decision-making requires educators to find or create appropriate assessment tools, gather meaningful assessment data, and interpret and make decisions based upon data (Barnes & Harlacher, 2008; Frey & Fisher, 2004; Fuchs & Fuchs, 2007). Finally, educators must implement small group or individualized interventions in tiers of increasing intensity to meet the specific needs of individual learners (Fuchs & Deschler, 2007; Mellard, 2008). Though MTI incorporates many practices of good teaching, these five components emerge as areas requiring refinement of practice.

Scale refinement. To help maximize item appropriateness, scale developers had all items reviewed by experts for relevance to the area of interest, MTI practices. Three focus groups participated in this part of the scale development process. The first focus group consisted of two university faculty who had researched MTI practices, and one experienced teacher. A second focus group consisted of general and special educators, specialists, and administrators active in MTI leadership. Focus group participants were asked if all relevant issues related to self-efficacy using MTI practices were represented and if there were items that needed to be added or omitted. This item review process was one way the researchers addressed the concern of sampling the content of this new area and confirming their theoretical framework of self-efficacy using MTI practices that they had constructed based upon their review of literature and professional experiences. Participants shared feedback about specific items, the scale as a whole, and the time required to complete the questionnaire.

The third focus group consisted of psychometric experts, two doctoral students in psychology assessment and their professor. In multiple sessions, that focus group mapped items to constructs, evaluated wording of items and response options, critiqued validation items, and required defense of items, allowing for elimination or refinement of items. During this scale refinement phase, one debated issue was the labeling of the anchors on the response scale. Several configurations were discussed including a sliding scale upon which respondents could place a marker indicating their level of agreement to statements regarding perceived competency in a particular area. Other options included language such as, "I do not know how to do this" and "I am an expert at this" to indicate levels of self-efficacy. Each proposed scale generated concerns from either the psychometricians or the teachers. The goal was to use language that would be understood and used consistently among the educators so that the results could be interpreted meaningfully. Interestingly, the focus group participants in this process helped to create a response option very similar to Florida's Perception of RTI Skills Survey (Florida Problem-Solving/Response to Intervention Project, 2008) though that study was published after this stage of this study. Focus group participants in this study justified answers ranging from "I'll take anything" to "I'm ready to help others," motivated by a desire to offer options which would limit defensiveness yet focus on self-efficacy for the specific behaviors. The initial version, the RTISES, is found in Appendix A.

Scale piloting. Finally, the RTISES was piloted using web-based survey software. Participants included three university faculty and 184 educators in three school districts. Most respondents served students in kindergarten through second grades (n=79, 42.2%) and/or third through fifth grades (n=71,

38%) with 31 respondents serving all grades (16.6%) and only three serving middle school or secondary grades (.5%). Survey participants included 87 general educators (46.5%), 38 special educators (20.3%), with 43 (23%) serving all students, and the rest serving specialized target populations.

Scale Quality

Reliability of Scale Scores

Procedure. The reliability of the scores from this new instrument was examined. First, to check the homogeneity of the items, a test of internal consistency was performed. The goal was to achieve a Cronbach's alpha of at least .90. Next, the item-total correlations were calculated. The goal was to have Pearsonian item-total correlations over .3.

Results. Cronbach's alpha based on the 58 standardized items was .976. Appendix C provides the results of the Pearsonian item-total correlation. Of these 58 items, 57 of them had correlation coefficients of over .3, most between .6 and .8. All correlations were statistically significant at the .001 level.

Constructs Characterizing the Item Set

Procedure. The researchers conducted a preliminary check to see if the set of items measured one broad construct, self-efficacy using MTI approaches, or several more specific constructs, such as the five areas explored in the item generation process. First, an 8-item subscale measuring the construct of general self-efficacy was included in the pilot to provide additional understanding of how the new items related to this general measure (Schwarzer & Jerusalem, 1993). The researchers expected that the responses to this subscale would be related positively to the responses on the new RTISES. Next, researchers examined the results of the factor analysis that used principal component analysis to generate initial values.

Results. The correlation between general self-efficacy subscale score and the RTISES total score was positive, but not strong: $r(155) = .14$, $p = .08$. While the correlation was not significant relative to the standard alpha level of .05, the p-value was less than .10. These eight items were not included in further scale analysis.

The factor analysis extracted 10 factors with initial Eigenvalues greater than one, however, there is one predominate component, initially labeled by the authors as self-efficacy in using MTI approaches, explaining nearly half of the variance. This result pro-vides encouragement for future work continuing to gather evidence to support a claim of unidimensionality of the construct (see Table 1, Figure 1 and Appendix B). Recall that the scale was designed to address the a priori framework of five components comprising self-efficacy using MTI approaches and that each item essentially appears twice – as an item addressing the need for information and as an item addressing the need for training in the instructional method. Therefore, the criteria number for factor extraction was set to five, instead of ten. The Rotated Component Matrix (Appendix D) shows how items loaded on five factors. SPSS output generated the labels Components 1 – 5 on the matrix. Bold type has been used in the matrix to flag strong values and to facilitate defining the substantive meaning of the factors that account for the set of items. Titles were assigned to the groups of items and used in Figures 2 and 3.

Table 1
First 10 Eigenvalues

Component	Total	% of Variance	Cumulative %
1	24.947	43.013	43.013
2	4.808	8.289	51.302
3	4.187	7.220	58.521
4	3.581	6.174	64.696
5	2.420	4.173	68.869
6	2.226	3.838	72.707
7	1.531	2.640	75.347
8	1.295	2.233	77.580
9	1.192	2.055	79.635
10	1.070	1.845	81.480

Examination of the Component Matrix revealed that the items did not load as expected based on the theoretical design of the issues related to self-efficacy in using the MTI approaches. Recall that the instrument was designed with five components in mind – universal design for learning, proficiency in judging evidence-based practices, collaboration, data-driven decision-making, and implementation of interventions. All items loaded positively on the first factor. Items addressing how to adapt learning activities to engage English Language Learners (ELLs) and how to allow ELL students to demonstrate learning loaded on a factor that had not been anticipated in the theoretical framework. Collaboration with grade level team members, items15 and 16, loaded on two different factors.
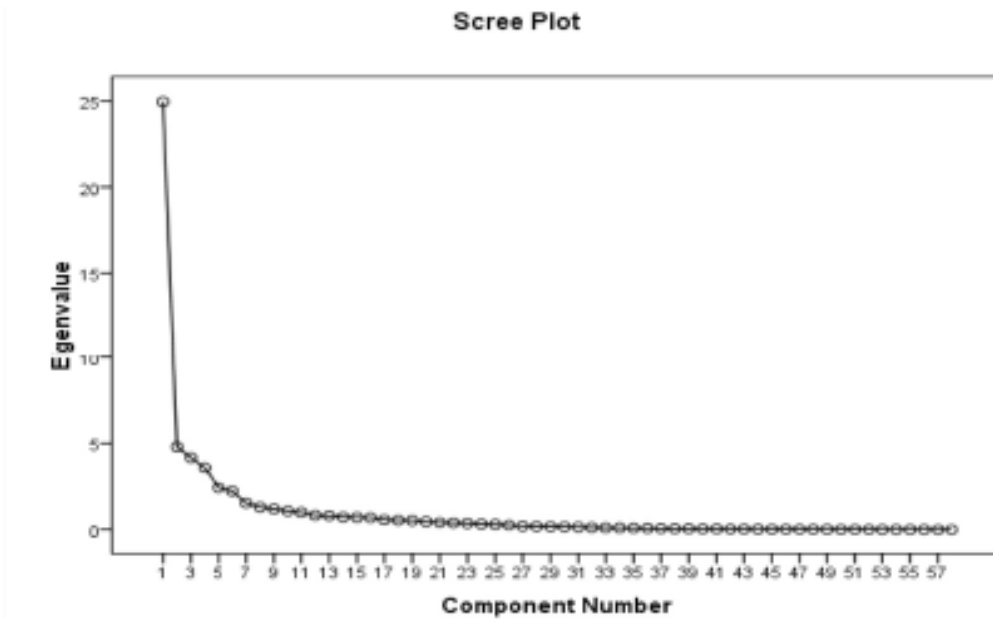
Figure 1. Components extracted by SPSS factor analysis from initial scale.

These items loaded with items addressing collaboration with professionals outside of the grade level teams and with using universal design. This analysis provided some evidence that self-efficacy in using the MTI approaches is not one broad construct, but rather several more specific ones. Using the information from loading patterns, the authors labeled the factors with titles descriptive of the items found there – universal design to teach and engage learners, meeting the needs of English language learners, seeking evidence-based support, collaboration, and using data for progress monitoring and implementing solutions for students. Figures 2 and 3 illustrate the a priori and new frameworks.
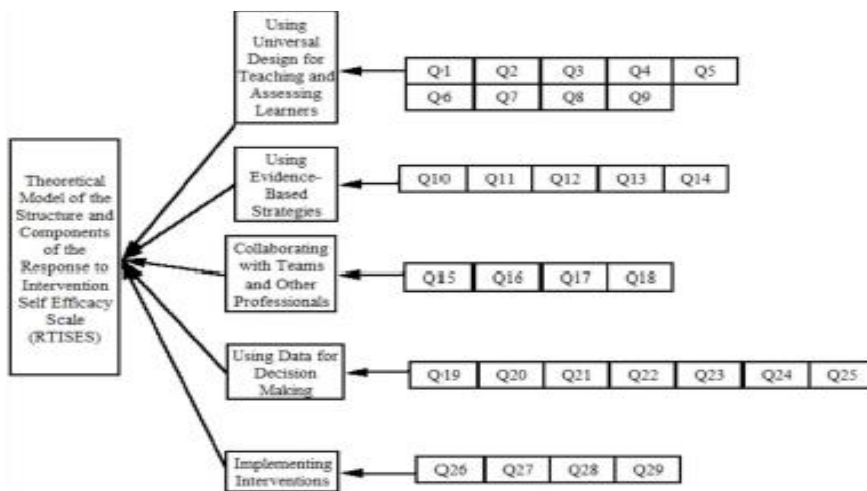

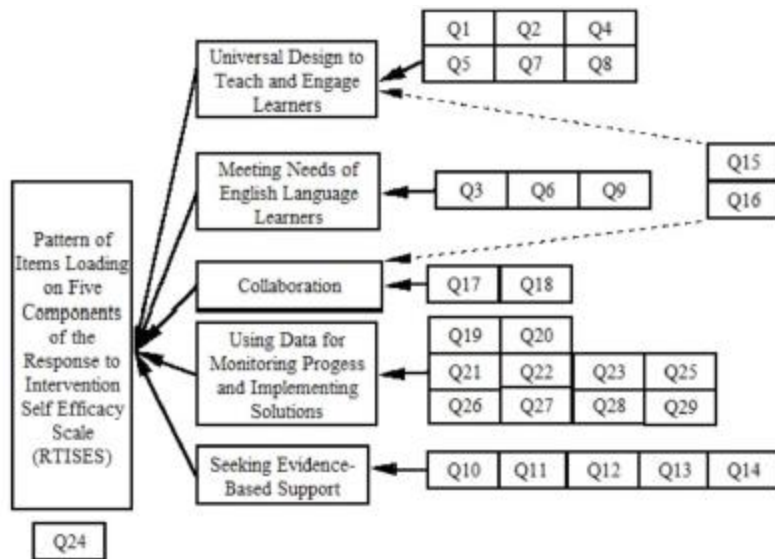Figure 2. Theoretical model of structure of the RTISES.

Figure 3. Pattern of items loading on five components of the RTISES.

The authors examined the correlation matrix for additional information to ad-dress scale quality. The extremely high correlations between the items looking at educators' perceived needs for more information and their perceived needs for related training (see Appendix E) prompted a closer exploration into scale length and the possibility of removing items without losing important information. The instrument design presented questions as sets of paired items wherein respondents were first asked to address their need for information in a particular area and then asked to address their need for training in that same area. Careful review of the correlations between the two items revealed that the bifurcated questions addressing information and training could be collapsed into a single item, thus reducing the scale by half. Because the purpose of the scale was to inform professional development needs, the items addressing information were eliminated and further analysis used the data from the items measuring the need for training.

One item addressing behavior did not fit with other items. While the other items did not specifically address teaching and learning in a strictly academic or cognitive processes domain, the implication was there. The stand-alone item (Q24) that addressed behavior in the social-emotional domain was dropped from the scale.

The authors analyzed how well the training items function without their companion information items. Reducing the number of items would benefit the survey respondents by reducing time needed to respond to the questions, but longer scales typically have higher reliability estimates. To estimate reliability, researchers calculated Cronbach's alpha for subscales to measure internal consistency and to evaluate how well these new subscales functioned. Cronbach's alpha reliability coefficients range between 0 and 1, with higher values indicating greater internal consistency. The results for this study are found in Table 2. Using the guidelines provided by a SPSS handbook (George & Mallery, 2005) the alpha values for these five new subscales (minimum alpha = 0.789 and maxi-mum alpha = 0.925) are considered to be very good to excellent. The measure of reliability for the total scale, the Cronbach's

alpha for 28 items, is .952, a very strong indication of overall internal consistency, but not an absolute indication of unidimensionality.

Factor analysis using just the training items extracted six factors with initial Ei-genvalues greater than 1, and one predominate component explaining 45 percent of the variance (See Figure 4). The Rotated Component Matrix (Appendix F) shows how items loaded on six factors. Bold type has been used in the matrix to flag strong values and to

Table 2
Item-Total Correlations for Subscales

Subscale	Number of Items	Items	Cronbach's Alpha
Differentiation to Assess and Engage Learners	6	1, 2, 4, 5, 7, 8	.914
Meeting Needs of English Language Learners	3	3, 6, 9	.789
Seeking Evidence-based Support	5	10, 11,12, 13, 14	.925
Collaboration	4	15, 16, 17, 18	.861
Data-driven Decision Making	10	19, 20, 21, 22, 23, 25, 26, 27, 28, 29	.911
Total Scale	28		.952

User-defined missing values are treated as missing.
Statistics are based on all cases with valid data for all variables in the procedure.

facilitate defining the substantive meaning of the factors that account for this smaller set of items. Examination of the Component Matrix revealed that using this reduced scale, the items loaded nearly as expected based on the theoretical design of the issues related to self-efficacy in using the MTI approaches. The five initial components (universal design for learning, proficiency in judging evidence-based practices, collaboration, data-driven decision-making, and implementation of interventions) and the additional component addressing how to engage and assess English Language Learners are represented here. Collaboration with professionals outside of the grade level teams emerged as a separate component. Titles were assigned to the groups of items and used in Figure 5.
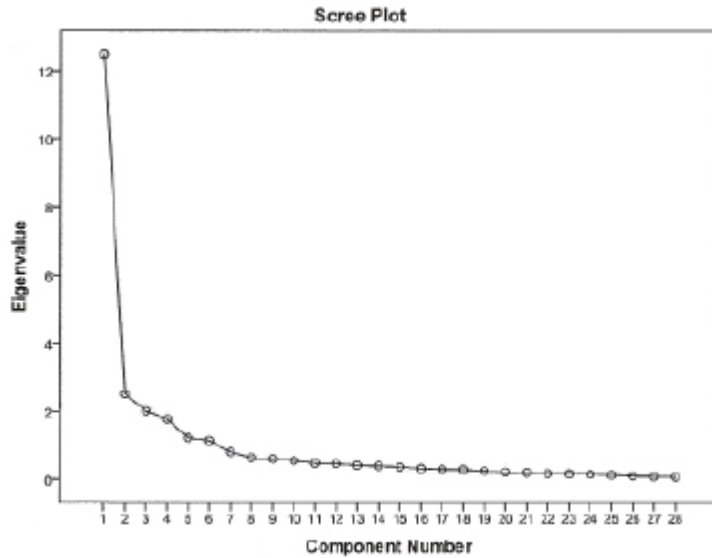
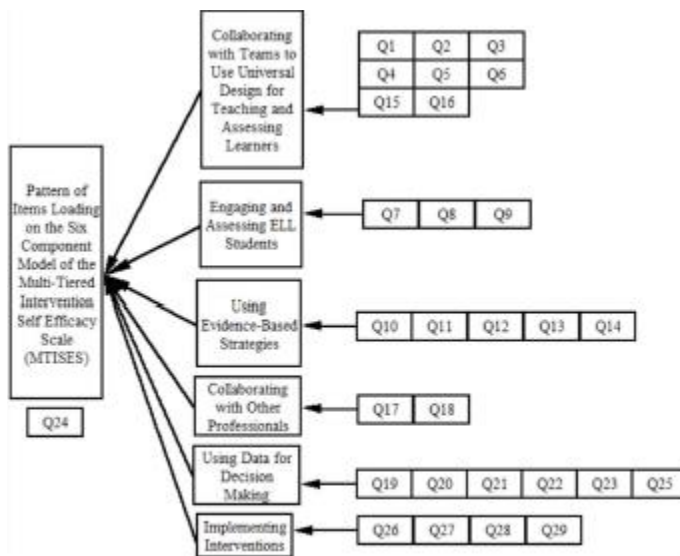Figure 4. Components extracted by SPSS factor analysis from revised scale.

Figure 5. Pattern of items loading on six components of revised MTISES.

Utility. In this small scale study, the researchers demonstrated the value of the RTISES as a measure of teacher self-efficacy specific to MTI practices, especially for the purpose of professional development needs analysis. The resulting MTISES worked to measure teacher self-efficacy for MTI practices in five specific areas of MTI practices. One next step is to determine the utility of this scale for similar purposes in a larger scale study. A second future step is to determine the utility of subscales of the MTISES for pre-post measures of gains made in response to professional development in those areas. Professional development modules and courses are currently under development for com-

ponents measured by the MTISES. Therefore, the researchers intend to study the utility of pre-post assessments connected to professional development modules and courses on each separate subscale of the MTISES.

Discussion and Practical Applications

The initial results of the instrument quality review provided some evidence that the resulting MTISES (Appendix G) measures teacher self-efficacy in using MTI approaches. Careful scale construction processes were used to maximize item appropriateness. The direction of the relationship between this scale and another scale of general self-efficacy were the same, but not highly correlated, indicating self-efficacy in these practices is different from general self-efficacy. Internal consistency was strong for the subscales and for the overall scale. It appeared that the areas in which the teachers saw the need for professional development did not align precisely with the conceptual map envisioned by the investigators. Specifically, respondents seemed to feel that meeting the needs of English Language Learners is different from meeting the needs of other learners and that behavior is a different concern than academic purposes. Using data from this develop-mental sample to investigate optimal scale length, the researchers found evidence that the scale works well with half of the RTISES items removed. The subscale responses indicated areas in which teachers felt they needed additional professional development.

The MTISES has practical applications for teacher education programs gathering data for accreditation purposes. Such accreditation is earned through meeting requirements of such organizations as the National Council for Accreditation of Teacher Education (NCATE) or the Teacher Education Accreditation Council (TEAC). Each accrediting agency requires data demonstrating that pre-service teachers have obtained quality levels of knowledge and skills relevant to teaching practices and evidence of value added through program participation (National Council for Accreditation of Teacher Education, 2011; Teacher Education Accreditation Council, 2011). One northeastern college's teacher education program is currently using the MTISES to assess student gains in components of multi-tiered instructional practices through participation in a course and paired field-based experience.

Professional development on specific components of RTI and MTI is essential to successful implementation of RTI and MTI practices. Various experts have proposed models for such professional development (Brown-Chidsey & Steege, 2005; Kratochwill, Clements & Kalymon, 2007; Kratochwill, Volpiansky, Clements, & Ball, 2007). To respond to the practical needs, the researchers are collaborating with experts in higher education institutions to post on-line professional development modules offering continuing education credits for educators and meeting introductory-level needs of both pre-service and in-service educators. These settings will provide opportunities for researchers to gather objective measures of the teachers' competencies implementing MTI approaches. For example, teachers could demonstrate their ability to interpret student assessment data before and after receiving data analysis training and then their scores on these assessments could be compared to the self-reported, self-perceived ability to do the same task. Objective measures will give researchers insight into the relationship between actual and perceived skill levels.

Ongoing follow-up studies using the instrument to measure a change in the level of self-efficacy before and after professional development will add to the fuller understanding of the utility of the scale to measure change and the effectiveness of training. One large mid-Atlantic urban school district proposed use of the MTISES as one pre/post-assessment of effectiveness of new professional

development initiatives. One research study in a southern state is currently using the MTISES as a pre/post- assessment instrument connected with district-wide professional development.

As both in-service training programs and pre-service teacher education programs implement professional development for MTI practices, instruments such as the MTISES are essential for identifying training needs and measuring gains in response to professional development. Results from all of these studies should demonstrate the utility of the MTISES for use in measuring change over time in response to professional development through post-secondary education.

Improving teacher quality through better teacher preparation and development is one of many ways that the P-12 and post-secondary education systems can collaborate. Summaries by the Education Commission of the States (ECS) describe other collaborative efforts, referred to as K-16 initiatives, including programs that focus on aligning standards and policies that develop cross-system structures (ECS Education Policy, 2011). Higher education assessment professionals are key stakeholders in the area of improving student learning by leading efforts to educate teachers, and also by making sure that their teacher preparation programs align with the P-12 curriculum and with licensure processes.

Conclusion

This study addressed key characteristics of the MTISES, specifically score reliability, the question of whether multi-tiered intervention self-efficacy has more than one specific construct, and the potential utility of the instrument. This initial administration and preliminary analysis of the MTISES provides researchers with guidance for further study, especially in the area of measuring change in self-efficacy after training. This work, along with repeated administrations of the test to increase the sample size, will add to the increasing evidence of construct and content validity of the scores.

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