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Validation of the Mediated Learning Observation Instrument Among Children With and Without Developmental Language Disorder in Dynamic Assessment

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ABSTRACT

Purpose: In this validation study, we examined the factor structure of the mediated learning observation (MLO) used during the teaching phase of dynamic assessment. As an indicator of validity, we evaluated whether the MLO factor structure was consistent across children with and without developmental language disorder (DLD).
Method: Two hundred twenty-four children (188 typically developing and 36 DLD) from kindergarten to second grade completed a 30-min individual mediated learning session on narrative production. Performance during the session was rated using the 12-item MLO by clinicians on affect, behavior, arousal, and elaboration. Exploratory and confirmatory factor analyses were conducted to establish the factor structure and reliability of the MLO.
Results: Factor analysis of the MLO suggested a stable three-factor model with adequate fit indices across kindergarten and school-age samples, across both typically developing and DLD subgroups with good to excellent reliability. The final 11-item MLO (one item was removed due to low factor loading) comprises three subscales including (a) cognitive factor, (b) learning anticipation, and (c) learning engagement.
Conclusions: The MLO is a valid and reliable instrument for assessing language learning skills in children with and without DLD during dynamic assessment. Practical implications and suggestions for future research addressing the utilization of MLO in dynamic assessment are provided.

The mediated learning observation (MLO) scale (Peña & Villarreal, 2000) provides clinicians with a way to rate a child's language learning skill during dynamic assessment. The MLO is a strong predictor of child language ability (Peña, Gillam, et al., 2006; Peña et al., 2007, 2014), indicating criterion validity. However, it requires validation to examine its internal structure and consistency as an indicator of construct validity. The present study aims to explore and validate the factor structure of the MLO instrument with a population of children with and without developmental language disorder (DLD) in kindergarten and early school age.

Dynamic assessment is a broad set of procedures that incorporate intervention into the assessment process (Lidz, 1991). By incorporating an intervention component into assessment, the examiner is able to observe a child's

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responsiveness to intervention, which is referred to as child modifiability. Observation of responsiveness to intervention, in contrast to a single-time observation of performance, is thought to reduce test bias that may be present when a child does not have the experiences with the tasks included on a given standardized measure (Lidz & Haywood, 2014). A test–teach–retest approach uses mediated learning experience (MLE), targeting language learning strategies during the teaching phase of the assessment to support and observe a child's learning in context. Observation of the child's ability to learn and apply language skills in the moment is in contrast to focusing on static decontextualized skills, which is the focus of most standardized testing.

Mediated Learning Experience

MLE describes the employment of learning principles that support the child in completed target tasks during the teaching portion of dynamic assessment. The learning principles of intentionality, mediation of meaning, transcendence, and planning are strategies that are used during the teaching phase of dynamic assessment and are essential for language learning. Together, these strategies promote a focus on understanding the teaching goal (intentionality) and its value or relevance for learning (mediation of meaning). As part of language teaching, the examiner helps the child to reason and think hypothetically about the learning goal (transcendence). Finally, in MLE, the examiner supports the development of a plan that the child can use to remember the learned strategies (planning; Haywood & Lidz, 2007; Peña et al., 2001). The inclusion of these strategies is necessary for the session to be considered as an MLE session.

MLE has been adapted for various language learning interventions within a dynamic assessment framework. In general, MLE allows observation of children's language learning abilities and is predictive of language ability. MLE has addressed vocabulary learning (Peña et al., 1992, 2001), novel word learning (Kapantzoglou et al., 2012), categorization (Mann et al., 2021; Ukrainetz et al., 2000), and production of narratives (Kramer et al., 2009; Peña et al., 2014; Petersen et al., 2017). In a randomized controlled trial, preschool children with DLDs in Hong Kong made greater improvements in cognitive and language skills when teachers used Feuristein's mediated learning strategies compared to a cognitive curriculum that did not incorporate MLE (Keung et al., 2022). For children second through seventh grades in English-as-a-second-language classes, mediated learning provided a means of allowing them to demonstrate their motivation to learn, attention to task, and curiosity for learning language (Mutlu & Şahin, 2019).

The use of MLE in dynamic assessment focuses on helping the child use various strategies to perform a task with and without examiner support. The MLO instrument was designed to guide observation of modifiability by focusing on strategies they are in the process of learning during the teaching session (Peña et al., 2007). This observation instrument was, in part, influenced by the tripartite model of attitudes (Breckler, 1984).

Tripartite Model and MLO Development

The tripartite model of attitudes consists of cognition, affect, and behavior (Breckler, 1984). Under this model, these three components work independently to explain cognitive modifiability, language attitudes, and achievement (Li & Wei, 2022; Peña et al., 2007).

Cognition is important for language learning because attending to what others are saying, remembering what has been said, and comparing what has been heard supports development of reasoning and problem solving. In structured learning contexts, children need to be aware of the learning aims and apply strategies to achieve the stated goals (Klein & Lee, 2006). Using language to talk through problems and to develop a plan allows a child to develop skills that will aid them as they learn new language skills. Flexibility is also critical, and children who are skilled language learners are able to readily apply the strategies they learn to various tasks, not simply the single task for which they are being taught the skill (Peña et al., 2007). Thus, cognitive skills allow a child to efficiently learn language, learn new information systematically, and flexibly apply learned strategies to new tasks.

Affect has to do with the individual motivation and how they respond when tasks become difficult and challenging. For example, children can persist and keep trying or stop attempting a task (Peña et al., 2007). By observing the child's responses while learning a task, the examiner can quantify the child's behavior, and this can help predict language learning achievement (Masgoret & Gardner, 2003; Peña et al., 2007). For example, a child can cooperate with the examiner, require redirection, or respond in a positive or negative way when the examiner provides feedback. Affect and behavior (social–emotional factors) are important because lack of motivation and difficulty following directions interfere with learning new information. Furthermore, positive and negative emotions are important factors in language learning (Botes et al., 2020; Li & Wei, 2022). If social–emotional factors are interfering with learning, then the speech-language pathologists (SLPs) can consider these factors in their approach as they work with the child on specific language goals.

Development of the MLO scale (Peña & Villarreal, 2000) was informed by the tripartite model and included four different subscales: arousal, elaboration, affect, and

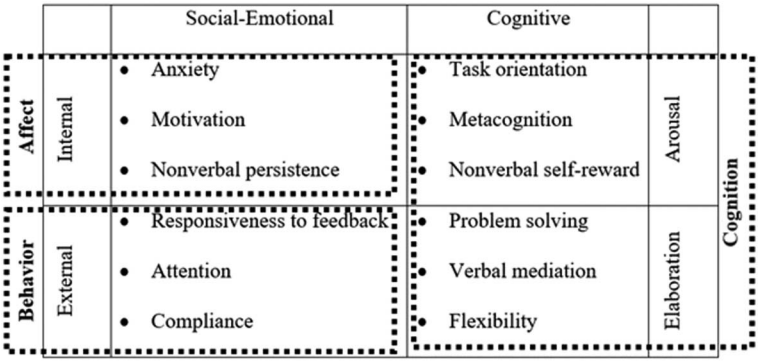
behavior (as shown in Figure 1). Cognitive arousal and cognitive elaboration subsections were posited to be in the cognition portion of the tripartite model. The internal and external social–emotional subsections included affect and behavior, respectively (Peña et al., 2007). Each subscale consists of three items on a 5-point scale, which allows easy and quick scoring during the dynamic assessment. The instrument aims to guide the SLP observation, which can be useful for structuring examiner impressions during the MLE portion of a dynamic assessment. The SLP can rate the child in each area of the four different subscales. For example, the SLP can rate the child's metacognition (cognitive arousal subscale) by documenting whether the child is aware of their own errors when participating in MLE. The MLO provides the SLP with a way to document behaviors associated with how the child learns and responds to feedback (behavior subscale). An example of documenting how the child learns and uses strategies that are taught to them can be documented through the rating on flexibility (cognitive elaboration). Typically developing (TD) children use multiple strategies to learn, while children with DLD may require more support to apply strategies to learn new information. The MLO provides information beyond what the child does correctly and incorrectly and provides information about how the child learns and which strategies may be helpful during treatment. The four areas evaluated on the MLO instrument are of known importance for efficient language learning in structured contexts. Although the MLO instrument has been used successfully for identification of DLD, its construct validity has not been evaluated. Factor analysis can be applied to determine if theoretical and exploratory frameworks for the MLO instrument are congruent.

Modifiability

Cognitive modifiability is a way to evaluate how efficiently children utilize cognitive and social–emotional factors during language learning. During MLE, the SLP observes how the child learns new information and notes strategies the child employs. Modifiability provides the SLP with a way to document the learning process and strategies used by the child. Castilla-Earls et al. (2020) reviewed 10 studies that used some form of MLE to teach language skills. Across these studies, five different observation frameworks were employed, which examined different aspects of modifiability, including attention to task, self-regulation, responsiveness to feedback, and flexibility. There were a total of 25 different items covered in five commonly used dynamic assessment observation scales, including the MLO instrument. The Learning Strategies Checklist (Lidz, 1991) has seven items that solely focus on cognitive learning strategies, while the Modifiability Scale (Lidz, 1987) has three items assessing cognitive learning strategies and learning potential to stimuli. The Modifiability Scale from the Predictive Early Assessment of Reading and Language (Petersen & Spencer, 2014) has four items evaluating four different learning behaviors, while the Modifiability Index (Petersen et al., 2017) has seven items focusing on six child behaviors during dynamic assessment and their learning potential. However, none of the studies have evaluated these frameworks through factor analysis to examine the underlying structure of MLE. The diverse items and focus of dynamic assessment observation scales suggest a need in understanding the dimensionality of MLE so that researchers can select appropriate scales to evaluate the zone of proximal development of children comprehensively and design appropriate intervention goals.

Observation of modifiability can assist in diagnostic decision making and can inform intervention. Diagnostically, modifiability ratings contribute to classification accuracy in conjunction with scores on standardized and nonstandardized language testing (Castilla-Earls et al., 2020). The observations made during the dynamic assessment can be incorporated into intervention plans for children with DLD (Moore-Brown et al., 2006). These

Figure 1. An overview of the theoretical mediated learning observation instrument and its scales. The dotted rectangles and the words in bold indicate the Tripartite Model of Attitudes (Katz & Stotland, 1959).



observations may be influenced by child characteristics such as language ability, bilingual status, and age.

Modifiability ratings, made during MLE, have been shown to differentiate between children with and without DLD. For example, in Peña et al.'s (2007) study, children with DLD needed higher support during a narrative learning task using the MLO. Children with typical development were better able to employ cognitive arousal (orientation, metacognition, and self-reward) and elaboration (problem solving, verbal mediation, and flexibility) strategies. There were smaller, significant differences between the two groups on affect (responsiveness to feedback, attention, compliance) and behavior (anxiety, motivation, and persistence). Similar patterns of performance were observed for bilingual children on this same task (Peña et al., 2014) with the greatest differences observed in task orientation, compliance, and metacognition.

In a study of Spanish–English bilingual second-grade children, Fiestas and Peña (2018) found that the language of instruction was related to clinician ratings of modifiability. More support was needed when the language of instruction was in the children's second language (English) compared to children who completed the narrative learning task in Spanish (their first language). Finally, the age groups for which these components are informative differ (Denessen et al., 2008; Peña, 2004; Peña et al., 2007). When evaluating children ranging from 3 to 14 years old, the perceived cognitive level of the child is what most determined the type of mediated learning that was used by mothers and older siblings during naturalistic observation of free-play and structured observation of analogy teaching (Tzuriel & Hanuka-Levy, 2019). In preschool-age children, the components of attention, self-regulation, transfer, and planning were significantly associated with language ability (Peña, 2000). This is in contrast to modifiability components associated with ability in kindergarten-age children (i.e., metacognition, oridentation, and compliance; Peña et al., 2014), and first and second graders where metacognition and flexibility were the best predictors of language ability (Peña et al., 2007).

Observation of modifiability provides data on the strategies that the child currently uses efficiently and inefficiently. With the information from MLO, the clinician can develop individualized intervention approaches to address language goals with the child. The individualized intervention approach provides an opportunity for a child to learn about how to utilize their strengths to efficiently learn new concepts.

Research Aims

The present study aimed to validate the structure of the MLO instrument in the population of children with DLD. There were two research questions for the current study. First, what is the factor structure of the MLO instrument? Second, is the factor structure of the MLO instrument stable across age groups and by language ability status? The first research aim, which was the exploration and validation of factor structure of the MLO instrument, will help researchers and clinicians understand the components of modifiability and whether the subscales in the MLO are sufficient to represent language modifiability in children. This also provides needed evidence for clinicians to adopt it in practice. The second research aim was to examine the factor stability of the MLO instrument. Understanding the construct can establish validity of the instrument in assessment and provide theoretical support to score interpretation (American Educational Research Association et al., 2014). Given that the MLO instrument is designed as part of the dynamic assessment tool, validation is important to examine its theoretical support in different clinical samples. A two-phase validation process was employed to address these research aims: (a) the factor structure and structural model of the MLO was evaluated and validated with a school-age sample and (b) the factor structure of the MLO was cross-validated with a kindergarten sample, TD children subgroup and children with DLD subgroup.

Method

Participants

Data for the current study were drawn from two existing data sets for a total of 224 unique participants who participated in dynamic assessment of narratives. We included 40 (15 with DLD) first- and second-grade predominantly English-speaking children (age range: 78–101 months) from the Nature and Measurement of Modifiability (NMM) data set (Peña, 1998) and 184 (21 with DLD) Spanish–English bilingual kindergarten children (age range: 60–79 months) from the Diagnostic Markers of Language Impairment (DM; Peña, Bedore, & Gillam, 2006). The NMM project tested the dynamic assessment of narratives (Miller et al., 2001) protocol, equalized and validated the pretest and posttest stories, compared story order effects, and expanded previous modifiability checklists to develop the MLO examined here. The DM study was a three-phase longitudinal study. The screening phase took place over 3 years beginning when children were in preschool with 1,192 children participating. Children who scored below the 30th percentile on one of two subtests in Spanish and one of two subtests in English and who used English and Spanish at least 20% of the time per parent report were recruited to the next two phases. During the longitudinal part of the study, children completed a

battery of standardized and language sample measures in kindergarten and first grade. They completed dynamic assessment of narratives (Miller et al., 2001) during Phase 2, when they were in kindergarten. Children were recruited from schools that enrolled children from diverse cultural–linguistic backgrounds in school districts in Texas and Utah. Ethics approval was obtained from the University of Texas at Austin and Utah State University, and parents completed signed consent forms. Table 1 presents the demographics of the participants.

Children were identified with DLD on the basis of converging evidence. For the NMM project, children were identified with DLD if they met two of the four criteria, teacher concern in the area of expressive or receptive language and/or speech and parent concern in the area of expressive or receptive language and/or speech; more than 15% syntactic, semantic, and/or pragmatic errors in a 10-min observation (Patterson & Gillam, 1995); and a score below −1 *SD* on the Test of Language Development–Primary: Third Edition (Newcomer & Hammill, 1997) or the Comprehensive Assessment of Spoken Language (Carrow-Woolfolk, 1999).

Children in the DM study were identified with DLD on the basis of expert review. Three bilingual SLPs independently reviewed test protocols, narrative samples, and teacher and parent questionnaires collected during Phase 3 of the study when children were in first grade. Based on their experience with providing services to bilingual children, the SLPs used Tomblin et al.'s (1996; Records & Tomblin, 1994) clinical judgment procedure to rate narration, vocabulary-semantics, and grammar in each language using a 6-point scale (0 = *severe/profound impairment*, 5 = *above normal performance*). They then made a summary rating based on their summary notes and ratings. Children were identified with DLD if two of the three raters' summary scores indicated mild, moderate, or severe DLD in the child's best language (Gillam et al., 2013, provide more detailed information about this procedure).

Measures

Participant data were aggregated across two studies in which research assistants completed the MLO instrument (Peña & Villarreal, 2000) as part of a scripted dynamic assessment protocol. The MLO instrument guides clinician judgment of the child's behavior during mediated learning sessions. The MLO contains 12 items across four subsections with three items per subsections. The subsections and items were distributed as follows: (a) arousal (task orientation, metacognition, nonverbal self-reward), (b) elaboration (e.g., problem solving, flexibility, verbal mediation), (c) affect (anxiety, motivation, persistence), and (d) behavior (responsiveness to feedback, attention, compliance). Examiners/research assistants rated each item from 1 (*requiring little examiner support*) to 5 (*requiring maximum examiner support*), with lower scores representing greater responsiveness to mediation. Ratings were conducted at the end of the first session given that raters are highly consistent in their modifiability rating ($r > .95$; Peña et al., 2007).

Clinician Training

Clinicians/testers across the two studies had research experience with young children. All testers for the DM study were Spanish–English bilinguals. They were either certified SLPs or bachelor's level research associates with

Table 1. Participants' demographics.

Participant characteristic	NMM data set				DM data set			
	n	%	*M*	*SD*	*n*	%	*M*	*SD*
Age in months			89.58	6.28			69.33	4.83
Ethnicity								
White	12	30.00			0	0		
Hispanic or Latino	13	32.50			176	95.65		
African American	13	32.50			1	0.01		
Others/unknown	2	5.00			7	3.80		
Sex								
Female	15	37.50			94	51.09		
Male	25	62.50			90	48.91		
English language exposure[a]							51.98	18.47
No. of students with free and reduced lunch[a]					150	81.52		
With developmental language disorder	15	37.50			21	11.41		

Note. NMM = Nature and Measurement of Modifiability; DM = Diagnostic Markers of Language Impairment.
[a]Only available for the DM data set.

extensive background working with bilingual children in school and research settings. Clinicians were trained to use the MLO form (Peña et al., 2007). They practiced rating recorded examples of MLE sessions until they reached 80% accuracy. As part of training, their scores were compared to the original scores and discussed.

Data for the DM study were collected by seven research assistants who were certified SLPs or SLP graduate students. Data for the NMM study were collected by nine clinicians. Of these, five were master of art students in communication sciences and disorders, three were certified SLPs, and one was a school psychologist.

Mediated Learning Session

Caregivers signed consent forms for participation in the study. All children participated in a 30-min individual mediated learning session. The session used for the MLO rating was based on the *Two Friends* story (Miller, 2000). Testers taught children story components (setting: time and place, character information and temporal order of events) as well as episode structure (initiating event, internal response, plan, attempt, consequence, reaction, ending). After the session, clinicians completed the MLO instrument for each child individually. These sessions are described by Peña, Gillam, et al. (2006).

Data Analysis

The hypothesized scales were extracted by exploratory factor analysis (EFA; Tabachnick et al., 2007) with 12 items from the MLO instrument using the school-age sample. Promax rotation was adopted given that the intercorrelations among factors were larger than .15 (Tabachnick et al., 2007). There were three considerations on retention and elimination of items, including (a) retaining items with eigenvalues higher than 1 and factor loading larger than 0.4, (b) retaining the factors with a minimum of three items, and (c) eliminating items with significant factor loadings on different factors (Hair et al., 2006; Straub, 1989). Next, using the factor structure obtained from the EFA, four different factor models were compared, namely, (a) single factor, (b) separate factors, (c) hierarchical factors, and (d) nested factors (Gustafsson & Balke, 1993). This step was to examine the internal factor structure of the MLO instrument. Prior literature suggested that for normal distributed and no missing data, 150 is considered as an adequate sample size (L. K. Muthén & Muthén, 2002). Given that the purpose of the current study was to validate a tool, the *n:q* criterion (where *n* is the sample size while *q* is the [free] model parameters) was considered using a ratio of 5:1 (Hu & Bentler, 1999; B. Muthén & Asparouhov, 2002; Yu, 2002). The factor models were assessed on six goodness of fit indices, including chi-square (χ^2), the chi-square divided by the degrees of freedom (χ^2/df), the comparative fit index (CFI), Tucker–Lewis index (TLI), standardized root-mean-square residual (SRMR), and root-mean-square error approximation (RMSEA), as suggested by Hu and Bentler (1999). Afterward, two multigroup paradigm confirmatory factor analyses (CFAs; Fischer & Karl, 2019; Joreskog & Sorbom, 2018; Tabachnick et al., 2007) were conducted to examine the stability of the factor structure across age groups and language ability status. The same set of goodness of fit indices was adopted for assessment. Finally, reliability of the subscales provided information on the consistency of the items. Also, mean correlations provided information on the degree of overlapping between subscales to ensure different subscales measure theoretically distinct constructs.

Results

MLO Factor Structure Identification

The basic structure of the 12-item MLO was verified using EFA. A significant result was noted in the Barlett's sphericity test, $\chi^2 = 341.78$, $p < .001$, while the Kaiser–Meyer–Olkin was equal to .84, implying adequate sample adequacy for the factor analysis (Kaiser, 1958). With the criteria of eigenvalues higher than 1 and factor loadings above 0.4, three factors were extracted and accounted for 75.13% of the variance, which suggests a satisfactory fit (Kline, 2014). Table 2 presents the three-factor structure and the factor loading of the EFA.

Compared with the four-factor hypothetical structure, the EFA suggested a three-factor empirical structure with some differences in factor and item configuration. Figure 2 presented the final factor structure. In terms of factor level, "problem solving," "flexibility" from cognitive elaboration subsection, "task orientation," "metacognition," and "nonverbal self-reward" from cognitive arousal subsection merged into one factor. "Motivation" from the internal social–emotional subsection, "verbal mediation" from the cognitive elaboration subsection and "responsiveness to feedback" from the external social emotional subsection formed the second factor. The third factor consisted of "attention" and "compliance" from the social–emotional subsection, and "anxiety" from the internal social–emotional subsection. With reference to the three-factor structure, the first factor is renamed as "cognitive factor," the second factor is renamed as "learning engagement," and the third factor is renamed as "learning anticipation." Regarding item-level findings, the item "nonverbal self-reward" was removed in the EFA due to

Table 2. Factor loadings of the rotated component matrix of the school-age sample (n = 40).

Component	Factor loadings		
	Cognitive factor	Learning engagement	Learning anticipation
Problem solving	1.12		
Flexibility	0.81		
Task orientation	0.71		
Metacognition	0.69		
Nonverbal self-reward	0.42		
Motivation		1.12	
Responsiveness to feedback		0.67	
Verbal mediation		0.51	
Anxiety			0.93
Attention			0.84
Compliance		0.42	0.59
Nonverbal persistence[a]			
Eigenvalues	6.60	1.41	1.01
% of variance	54.98	11.72	8.43
Cumulative % of variance	54.98	66.70	75.13

Note. Extraction method: principal axis factoring; rotation method: promax rotation with Kaiser normalization, rotation converged in five iterations.
[a]Nonverbal persistence did not have a factor loading over .4 in all three factors.

factor loading below 0.4 in all factors. Also, "compliance" had both over 0.4 factor loading in factor "learning engagement" and "language anticipation." Considering the factor loading value and the connections between other items in the factor, "compliance" was regarded as a component in "learning anticipation" for later analysis. The three-factor model with 11 items was used in below analyses. The Appendix shows the revised version of the MLO.

Structure Model Comparison

The structure of the MLO was further tested by comparing the goodness of fit of four possible models (i.e., single, separate, hierarchical, and nested factor models). Table 3 presents the goodness of fits for different models.

Figure 2. An overview of the exploratory mediated learning observation instrument and its scales.

	Learning	Cognitive
Anticipation	• Anxiety • Attention • Compliance	• Task orientation • Metacognition • Nonverbal self-reward
Engagement	• Motivation • Responsiveness to feedback • Verbal mediation	• Problem solving • Flexibility

The separate factor model (i.e., a three-factor model) provided the best fit indexes among the four models. The model was regarded as a generally acceptable fit with reference to Kenny et al. (2015), Hu and Bentler (1999), and Ullman (2013), with $\chi^2(41) = 62.05$, $\chi^2/df = 1.51$, $p = .02$, SRMR = .08, CFI = .92, TLI = .91, RMSEA = .12. In addition, the regression weight of the items ranged from .39 to .91, $ps < .05$ (as shown in Table 4).

Structure Model Verification

Two multigroup paradigm CFAs were conducted on age (i.e., kindergarten and school-age sample) and language ability status (i.e., TD and DLD groups) to examine the stability and generalization of the three-factor structure from the EFA. Regarding the multigroup paradigm on age, the three-factor model yielded a generally acceptable fit, with $\chi^2(82) = 252.03$, $\chi^2/df = 3.07$, $p < .001$, SRMR = .07, CFI = .91, TLI = .89, RMSEA = .11. In addition, the regression weight of the items ranged from .39 to .91, $ps < .001$ (as shown in Table 4). Regarding the multigroup paradigm on language ability status, the three-factor model yielded a generally acceptable fit, with $\chi^2(82) = 252.62$, $\chi^2/df = 3.08$, $p < .05$, SRMR = .08, CFI = .90, TLI = .88, RMSEA = .12. In addition, the regression weight of the items ranged from .30 to .91, $ps < .05$ (as shown in Table 4).

Reliability and Internal Stability

Cronbach's alpha was estimated to evaluate the internal stability of the MLO for the school-age and

Table 3. Goodness of fit for various structure models.

Model	χ^2	*df*	χ^2/df	*p*	CFI	TLI	SRMR	RMSEA
Single	127.81	54	2.37	< .001	.77	.72	.10	.19
Separate	62.05	41	1.51	.02	.90	.92	.08	.12
Hierarchical	100.27	44	2.28	< .001	.78	.73	.11	.18
Nested[a]	40.82	33	1.24	.16	N/A	N/A	N/A	N/A

Note. The comparison was based on the school-age sample (N = 40). CFI = comparative fit index; TLI = Tucker–Lewis index; SRMR = standardized root-mean-square residual; RMSEA = root-mean-square error approximation.

[a]The iteration limit of the model was reached, and the model was not significant and did not have goodness-of-fit indexes.

kindergarten samples, and the TD and DLD subgroups. The 11-item instrument had Cronbach's alpha of .90–.92 across groups, which indicated excellent internal consistency (Hair et al., 2010). Table 5 presents the subscale reliability and the correlation between subscales. The subscale reliability across groups ranged from .79 to .93, indicating good to excellent internal consistency.

In addition, we compared the correlation between subscales across groups. Generally, the mean correlations among groups were moderate, with ranges from .46 to .73. As shown in Table 5, higher correlations between cognitive factor and learning engagement were observed while lower correlations between cognitive factor and learning anticipation were observed across groups. The moderate correlations suggested that the subscales measured related but nonoverlapping constructs.

Discussion

This study described development and validation of the MLO instrument to evaluate learner modifiability in dynamic narrative assessment. The final MLO instrument resulted in 11 items in three subscales: (a) cognitive factor, (b) learning anticipation, and (c) learning engagement.

Three-Factor Structure of MLO and Tripartite Model

The stable three-factor structure of the MLO was consistent with the two major components of the tripartite model of attitudes by Katz and Stotland (1959): cognition (represented by the cognitive factor) and social–emotion (represented by learning anticipation and learning engagement). This was further confirmed by the separate structure of the model. In addition, the same factor structure was validated among the TD and DLD subgroups and the kindergarten and school-age subgroups. The identification of the cognitive factor supports that cognitive arousal and cognitive elaboration work closely together during mediated learning. Thus, the two original subscales (i.e., cognitive arousal and elaboration) were combined. With reference to the MLO, the cognitive factor can be referred to children's ability to keep on task and use strategies during learning as well as the ability to continuously monitor learning progress. These cognitive processes work jointly to help students actively participate during the mediated learning activities. Regarding the affect and behavior components, the EFA result suggested the two components be reclassified as learning anticipation and learning engagement. This can be explained by the close connection

Table 4. Regression coefficients of the items for different samples and subgroups.

Component	School-age sample (n = 40)	Preschool sample (n = 184)	TD subgroup (n = 188)	DLD subgroup (n = 36)
Problem solving	.84	.89	.87	.74
Flexibility	.76	.91	.87	.77
Task orientation	.91	.89	.87	.89
Metacognition	.88	.86	.83	.84
Nonverbal self-reward	.39	.76	.71	.48
Motivation	.81	.78	.79	.75
Responsiveness to feedback	.90	.75	.79	.73
Verbal mediation	.70	.76	.71	.84
Anxiety	.73	.67	.82	.30
Attention	.79	.74	.79	.70
Compliance	.84	.87	.78	.91

Note. TD = typically developing; DLD = developmental language disorder.

Table 5. Internal consistency reliability (alpha coefficient) and discriminant validity (correlation with other scales) in (a) the school-age sample (n = 40), (b) the kindergarten sample (n = 184), (c) typically developing subgroup (n = 188), and (d) developmental language disorder subgroup (n = 36).

Subscale	No. of items	Alpha reliability	Mean correlation	Correlations			Alpha reliability	Mean correlation	Correlations		
				CF	LE	LA			CF	LE	LA
		(a) School-age sample (n = 40)					(b) Kindergarten sample (n = 184)				
CF	5	.87	.62	—			.93	.67	—		
LE	3	.83	.62	.72	—		.80	.73	.79	—	
LA	3	.82	.52	.52	.51	—	.82	.61	.55	.67	—
		(c) Typically developing subgroup (n = 188)					(d) Developmental language disorder subgroup (n = 36)				
CF	5	.92	.64	—			.85	.60	—		
LE	3	.79	.71	.76	—		.82	.63	.77	—	
LA	3	.83	.58	.51	.65	—	.73	.46	.43	.49	—

Note. CF = cognitive factor; LE = learning engagement; LA = learning anticipation.

between emotion and behavior during observation of clinicians as they deduce students' emotions through their behavior. The two factors under the social–emotion component, namely, learning anticipation and learning engagement, represent different aspects of learning participation. Learning anticipation can be referred to as the foundational learning emotions and behavior that support the learning process while learning engagement can be referred to as the active involvement to the learning activities. The items in these two factors suggest there were different sets of affect and behavior to archive learning anticipation and learning engagement. The current finding can also be considered not only for dynamic assessment of narrative but also evaluated for their use in other dynamic assessment tasks since cognitive skills, learning anticipation, and learning engagement are required.

Use of MLO in Clinical Setting

The validation of the MLO makes a unique contribution in terms of setting, target participants, and age groups. With the wide use of dynamic assessment across areas of practice in speech and language pathology (Gillam et al., 1999; Glaspey et al., 2022; Peña et al., 2001, 2014), the MLO can help SLPs to evaluate the learning modifiability of monolingual and bilingual students from kindergarten to early school age. In addition, the factor structure of learning modifiability was consistent between TD students and students with DLD, suggesting that the MLO can be applied in the clinical settings to evaluate the learning modifiability of these two groups of students. Furthermore, the MLO instrument was validated in both kindergarten and school-age samples, suggesting that the age range is suitable for the optimal time points for diagnosing DLD suggested by Sansavini et al. (2021). Thus, the novelty of this study is noted in the applicability in language assessment and the appropriateness of the age range.

Clinical Implications

There are two major clinical implications of the validation of the MLO on assessment and intervention. First, the MLO provides additional information to dynamic assessment of language. During the dynamic assessment, the MLO can help clinicians evaluate the students' cognitive, affect, and behavioral strengths and weaknesses in order to obtain additional information that is relevant to language learning. With reference to the three-factor model of MLO, clinicians can gain information about students' readiness for learning (learning anticipation), the degree of participation (learning engagement), and the use of cognitive strategies (cognitive factor). These factors may be important for clinicians when determining the prognosis of the child. Thus, the MLO can provide a more holistic view of the student's learning profile for clinicians.

Second, the validated MLO can help clinicians design individualized intervention approaches based on the ratings. The result of the MLO, with reference to the three factors, reflects the student's MLE in dynamic assessment. Clinicians can use this information to deduce the optimal mediated interaction in the intervention to facilitate engagement and self-regulated behaviors in language learning (Lidz & Peña, 1996). For example, when designing intervention goals, clinicians can consider and incorporate the strengths of the child to enhance treatment effectiveness. If a child has a lower rating on the cognitive factor indicating greater need in this area, the clinician can work with the child to increase awareness of the errors they made and apply strategies to correct the errors.

In addition, clinicians may wish to modify the activities, settings, or treatment approaches through use of a reinforcement schedule related to the areas where the student had lower ratings. This can facilitate students' ability to learn various cognitive strategies and adopt various strategies during formal language learning (Peña et al., 2007).

Limitations and Future Directions

Despite its unique contributions, the current study has at least two limitations. First, the current validation process was only conducted with students from kindergarten to Grade 2. The factor structure of learning modifiability might not be applicable to older students due to higher language demands (Joffe & Nippold, 2012) and more sophisticated learning strategies (Paris & Newman, 1990). Second, the impact of comorbidity of disorders was not assessed. For example, children with special learning disabilities have reported having difficulties in emotional understanding, resulting in lower cognitive modifiability and psychological resilience during learning (Bloom & Heath, 2010; Tzuriel & Shomron, 2018). Thus, learner modifiability may be altered by the co-existence of other disorders.

Future research should explore how children's characteristics may affect the MLE. Specifically, the students' personalities and impact of comorbidity on MLE can be examined. Personality was found to affect cognitive functioning and engagement during the learning process since this affects students' self-concept and self-esteem (Ziegler et al., 2010). Different learning disabilities, such as autism spectrum disorder, attention-deficit/hyperactive disorder, and specific learning disabilities, have been shown to affect understanding the social and emotional context in learning (Tzuriel, 2021; Tzuriel & Bettan, 2007; Tzuriel & Groman, 2017). Thus, with the development of the MLO, research can examine the relationship between personality traits, comorbidity, and mediated learning in language learning. In addition, future research can utilize the validated MLO in intervention studies other than narrative assessments to examine the changes in students' learning modifiability. As mediated learning focuses on facilitating the cognitive process to internalize the learning strategies so that students can apply them independently (Haywood & Tzuriel, 1992; Tzuriel, 2000), language intervention studies can adopt the MLO to help evaluate the intervention effectiveness.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author, J. H. Y. Lam, upon reasonable request.

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Appendix

Mediated Learning Observation–Revised

Cognitive factor					
	5	**4**	**3**	**2**	**1**
Problem-solving	Systematic and efficient, used forethought, reflection	Organized, but somewhat inefficient (less than 25% off task)	Sketchy plan, trial and error	Disorganized, haphazard plan	No plan; unsystematic guessing
Flexibility	Uses multiple strategies readily	Has preferred strategies, but can change when necessary	Some evidence of more than one strategy and occasionally utilizes them	Recognizes limitations of strategy, but cannot see alternatives	Persists with one strategy, regardless of outcome
Task orientation	Completely understands tasks	Mostly understands tasks (75%)	Understands tasks some of the time (50%)	Often does not understand tasks (25% of the time)	Doesn't understand tasks
Meta-cognition	Aware of all errors	Aware of most errors (75%)	Aware of some errors (50%)	Unaware of most errors (25%)	Unaware of any errors
Nonverbal self-reward	Positive response to task regardless of difficulty	Positive response related to task difficulty	Demonstrates insecurity, positive and negative responses related to difficulty	Negative response related to task difficulty	Negative response regardless of task difficulty
Comments					
Learning engagement					
	5	**4**	**3**	**2**	**1**
Motivation	Enthusiastic, engages in tasks readily	Curious, shows interest	Ambivalent, unsure about tasks	Guarded, seems fearful of tasks	Avoidant, does not want to engage
Responsiveness to feedback	Very positive, maintains enthusiasm	Positive, but hesitant; requires some feedback	No response to feedback	Negative, disheartened; requires much feedback	Very negative, rejects feedback
Verbal mediation	Elaborates plan clearly	Talks through problem	Talks occasionally	1–2 word utterances only	No verbal mediation
Comments					
Language anticipation					
	5	**4**	**3**	**2**	**1**
Anxiety	Calm, little to no soothing required	Fidgety, but can be soothed	Uncomfortable, breaks needed to sooth	Distressed, much soothing required	Distraught, crying, cannot be soothed
Attention	Attentive and focused	Focused, but distractible at times	Distractible, but can be refocused, needs prompting	Distracted, and difficult to refocus	Distracted and off task
Compliance	Cooperative	Insecure	Hesitant	Uncooperative	Refusing
Comments					