Comparative Validity of Computerized and Hand Scoring of the LEAS

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Abstract

The Levels of Emotional Awareness Scale (LEAS; Lane, Quinlan, Schwartz, Walker, & Zeitlan, 1990) is an open-ended test that measures the ability to use emotion words in a complex and differentiated fashion. Previous research has demonstrated that the LEAS is reliable and valid when it is scored by hand, and that Emotional Awareness is associated with a variety clinically important outcome variables. This research has inspired the development of alternative forms of the LEAS, including the LEAS-C (Bajgar, Ciarrochi, Lane, & Deane, 2005), which was designed to assess Emotional Awareness in children, and the Computerized LEAS (Barchard & Leaf, in prep), which allows data to be collected online.

Scoring the LEAS by hand is time-consuming. Therefore, previous research has explored the feasibility of using computerized scoring instead. Barchard and Leaf (in prep) found high correlations between hand scoring and computerized scoring of the original LEAS. These promising results suggest it may also be feasible to score alternative forms of the LEAS using the computer.

The purpose of the current study was to determine if computerized scoring is as reliable and valid as hand scoring for the two alternative forms of the LEAS discussed above. We used a sample of 51 children who completed the LEAS-C and a sample of 66 college students who completed the Computerized LEAS. We scored these tests using hand scoring and Program for Open-Ended Scoring (POES; Leaf & Barchard, 2006). POES uses four methods to calculate scores: these are called Highest-4, All-Sum, 334, and 3345. All scoring methods had high internal consistencies, but internal consistency for the Highest-4 and All-Sum methods was higher than the internal consistency for hand scoring. For the LEAS-C, POES scoring and hand scoring had similar – albeit small – correlations with Emotion Comprehension and Vocabulary, but Highest-4 and All-Sum had significantly higher correlations with Emotion Expressions (the ability to recognize emotions) than hand scoring did. We conclude POES scoring can be as reliable and valid as hand scoring of alternative forms of the LEAS, and the Highest-4 and All-Sum methods may in some cases be more reliable and valid than hand scoring.

Introduction

The Levels of Emotional Awareness Scale (LEAS; Lane, Quinlan, Schwartz, Walker, & Zeitlan, 1990) is an open-ended test of the ability to use emotion words in a complex and differentiated fashion. Respondents describe how they would feel in emotionally evocative situations, and their responses are scored based upon their structure. Because the LEAS is open-ended, it takes a long time to score. In the first author's lab, training a new LEAS scorer can take up to 10 hours. Once trained, LEAS scorers can take up to 20 minutes for each respondent. Thus, a new scorer may take up to 43 hours to score the LEAS for 100 respondents, and an experienced and efficient LEAS scorer will still take 10 minutes per respondent or roughly 17 hours for 100. The amount of time involved in training and scoring is perhaps the primary reason that researchers and clinicians have not used the LEAS more often.

The LEAS is based upon a five-tiered developmental theory of Emotional Awareness (Lane & Schwartz, 1987), modeled after Piaget's theory of cognitive development. In this theory, each level represents a greater degree of differentiation and integration of emotional experiences. These levels are (1) bodily sensations (I would feel pain), (2) action tendencies (I would cry), (3) single emotions (I would feel angry), (4) blends of emotion (I would feel happy but guilty), and (5) combinations of blends (I would feel sad and frightened. My friend would feel sympathetic and relieved). In hand scoring, each item on the LEAS receives a score ranging from 0 (no awareness) to 5 (the highest level of awareness).

A variety of studies have demonstrated the clinical relevance of the LEAS. LEAS scores are lower in people with somatoform disorders (Subic-Wrana, Bruder, Thomas, Gaus, Merkle, Köhle, 2002), and increase over the course of treatment for people with somatoform disorders independent of changes in negative affect (Subic-Wrana, Bruder, Thomas, Lane, & Köhle, 2005). In addition, LEAS scores are lower in people with depression (Berthoz, Ouhayoun, Parage, Kirzenbaum, Bourgey, & Allilaire, 2000; Donges, Kersting, Dannlowski, Lalee-Mentzel, Arolt, & Suslow, 2005), eating disorders (Bydlowski et al., 2005), and borderline personality disorder (Levine, Marziali, & Hood, 1997), and distinguish people with generalized anxiety disorder from controls (Novick-Kline, Turk, Mennin, Hoyt, & Gallagher, 2005).

LEAS scores are associated with both self-report and objective measures related to Emotional Awareness. First, LEAS scores are associated with lower scores on the Toronto Alexithymia Scale – Revised (TAS-20; Bagby, Taylor, & Parker, 1994), a self-report measure of difficulty expressing feelings (Lane, Sechrest, & Riedel, 1998; Rose, 2004; Waller & Scheidt, 2004; Walgren, 1996). The LEAS also accounts for a significant portion of the variance in the TAS-20 above and beyond other relevant predictors (Walgren, 1996). Second, LEAS scores are correlated with changes in cerebral blood flow associated with film- and recall-induced emotional

experiences (Lane, Reiman, Axelrod, Yun, Holmes, & Schwartz, 1998), and are related to higher accuracy in the perception of emotion (Lane, Sechrest, Reidel, Weldon, Kaszniak, & Schwartz, 1996; Lane, Sechrest, Riedel, Shapiro, & Kaszniak, 2000).

The strong reliability and validity evidence for the LEAS has inspired the development of alternative forms. The first of these is the Levels of Emotional Awareness Scale for Children (LEAS-C; Bajgar, Ciarrochi, Lane, & Deane, 2005). This 12-item paper-based measure was modeled after the adult LEAS, and is designed to measure Emotional Awareness in children. The second is the Computerized LEAS (Barchard & Leaf, in prep). This computer-administered measure is based directly upon the adult LEAS, and could be used when collecting data in an online study. The same 20 items are used, although they are divided into two web pages.

Despite its clinical relevance and construct validity, the use of the LEAS has been constrained by lengthy scoring time. Therefore, previous research has explored the feasibility of using computerized scoring instead. Barchard and Leaf (in prep) found high correlations between hand scoring and computerized scoring of the original LEAS. These promising results suggest it may also be feasible to score alternative forms of the LEAS using the computer. The purpose of the current study was to determine if computerized scoring is as reliable and valid as hand scoring for the two alternative forms of the LEAS discussed above.

Method

Participants

Sample 1: Children

Fifty-one children between the ages of 10 and 11 were recruited from two private schools in a regional city with a population of 180,000. There were 25 females (M_{age} 10.3, SD.46) and 26 males (M_{age} 10.3, SD .49). All children came from middle class backgrounds with the majority of parents working in professional or semi-professional occupations. Five children were of non-English speaking cultural backgrounds. However, all children were identified as competent English speakers.

Sample 2: Adult University Students

Sixty-six university students (52 female, 14 male) participated in return for course credit. They ranged in age from 18 to 46 (mean 24.7, SD 8.1). Participants identified themselves as follows: 62% White/Caucasian, 9% Black/African American, 8% Hispanic, 6% Pacific Islander and 6% Asian. All participants either spoke English as their first language or had been speaking English for at least 10 years and reported being very comfortable reading and writing in English.

Measures

Levels of Emotional Awareness Scale

Levels of Emotional Awareness Scale for Children

The children in Sample 1 completed the paper-administered Levels of Emotional Awareness Scale for Children (LEAS-C; Bajgar et al., 2005). The LEAS-C consists of 12 scenarios, each involving oneself and another person. For each scenario, children answer two questions: "How would you feel?" and "How would the other person feel?" In this study, the LEAS-C scenarios were read aloud to the children, while the children read silently. The children then provided written responses to the two questions.

Computer-administered LEAS

The adult students in Sample 2 completed the computer-administered LEAS. It consists of two web pages, each containing ten of the adult LEAS items. For each item, the scenario description was followed by two prompts: "How would you feel?" and "How would the other person feel?" After each prompt, a text input box (8 rows by 40 columns) collected participants' responses. These web pages were uploaded to the university server so they could be accessed from university computer labs via the Internet.

Scoring

For both versions of the LEAS, responses were scored in two ways. First, responses were scored using the hand-scoring method described in the manual for the adult version of the paper-based LEAS (Lane, 1991). See Appendix A for details regarding hand scoring. Second, responses were spell-checked and then scored using Program for Open-Ended Scoring (POES) version 1.2.2 (Leaf & Barchard, 2006), using LEAS Wordlist 2.1 (Barchard, 2006). See Appendix B for a detailed description of POES scoring.

POES calculates four types of scores: All-Sum, Highest-4, 334, and 3345. The 3345 score can only be calculated when the LEAS is administered on the computer, because this method uses the two separate text input boxes to distinguish between emotions attributed to self and emotions attributed to another, in order to more accurately mimic the hand scoring approach. Therefore, all four POES scores were calculated for the adult students in Sample 2, which used the computer-administered LEAS, but only the first three POES scores were calculated for the children in Sample 1, which used the paper-based LEAS-C. Because the 334 and 3345 methods are logically closest to hand scoring (see Appendix B for details), we expected them to have higher correlations with hand scoring and more similar correlations with the criterion variables.

Emotion Expressions

The children in Sample 1 were presented with a series of 18 photos of adults posing one of six emotions (anger, surprise, sadness, disgust, joy or fear). These photos were derived from two sources, Izard's I-M series (Izard, 1971) and the Glenn pictures (Glenn, 1974). The series of photos selected for this task was recommended by C. Izard (personal communication, April, 2000). With each photo presentation, children wrote down what they thought the person was feeling. Responses were scored according to accuracy and valence: a score of 2 indicated the correct emotion or a synonym, a score of 1 indicated an incorrect emotion but the correct valence, while 0 indicated both emotion and valence were incorrect.

Emotion Comprehension

The children in Sample 1 completed an Emotion Comprehension task (Cermele, Ackerman & Izard, 1995). This task consisted of a series of emotionally evocative scenarios. In the 18 scenarios in the first section, children selected the emotional response of the protagonist from the following list: happy, sad, mad, interested, or ashamed. In the nine scenarios in the second section, children selected from a slightly different array of emotional responses: happy, mad, proud, guilty, ashamed, or looking down on someone. Similar to the Emotion Expression task, responses were scored according to accuracy and valence.

Vocabulary

The children in Sample 1 completed the vocabulary subtest of the Wechsler Intelligence Scale for Children (WISC-III; Wechsler, 1991). A list of fifteen words was read aloud to students, the starting point for the list corresponding to the lowest age of the participants (Sattler, 1992). As each word was presented, students wrote down its meaning. In this study, internal consistency of the vocabulary subtest was $\alpha = .71$.

Results

Internal Consistency

For both the child and adult samples, the four POES scoring methods had acceptable internal consistencies. See Table 1. The Highest-4 and All-Sum methods had the highest internal consistencies in both samples. The internal consistencies for the 334 and 3345 methods were the most similar to hand scoring, and in most cases, coefficient alpha for these two POES methods was not significantly different from coefficient alpha for hand scoring.

Correlations of the Four POES Scores with Hand Scoring

For both samples, each of the four POES scores had high correlations with hand scoring, indicating that all POES scoring methods are tapping the same general construct as hand scoring. See the second column of Table 2.

Next, we wanted to determine which POES methods had the highest correlations with hand scoring. We had hypothesized that the methods that were logically most similar to hand scoring – the 3345 and 334 methods – would have higher correlations with hand scoring than the All-Sum and Highest-4 methods. This was not uniformly true. In both samples, the 334 method did have higher correlations with hand scoring than the All-Sum method had, and in one of the samples this difference reached statistical significance. However, the 334 method did not always have higher correlations than the Highest-4 method, and these differences never reached statistical significance. We conclude that the 334 method and Highest-4 methods are roughly comparable in terms of their correlation with hand scoring.

The 3345 method had a significantly higher correlation with hand scoring than any of the other POES scoring methods, in the one sample (adult students) in which it was calculated. Because it was possible to use this scoring method only in the sample that used the computer-administered LEAS, this result requires replication before we can be confident that the 3345 method has the highest correlation with hand scoring.

To further examine the similarity of the constructs underlying these scoring methods, two additional analyses were conducted. First, we corrected these correlations for attenuation due to lack of internal consistency. See Table 2 column 3. These corrected correlations were often quite high, and for the Computerized LEAS used in Sample 2 (adult students) the corrected correlations for the 334 and 3345 method were very close to 1. For the LEAS-C used in Sample 1 (children), the corrected correlations were somewhat low. It may be that the lower Emotional Awareness of children results in restriction of range, which reduces these correlations.

Correlations with Criterion Variables

Bajgar et al. (2005) correlated hand scoring with Emotion Expressions, Emotion Comprehension, and Vocabulary for the children in Sample 1. The purpose of the current study was to determine if the correlations for POES scoring would be similar to the correlations reported by Bajgar et al. for hand scoring. We therefore correlated the three POES scores with each of the three criterion variables. The second column in Table 3 shows that all three POES scoring methods had significant (or nearly significant) correlations with each of the three criterion variables. These results provide evidence for the validity of all three POES scoring methods. The correlations for the Highest-4 and All-Sum methods were significantly higher than the correlations for hand scoring, but because these results were obtained in only one sample using only one particular LEAS hand scorer, these results require replication before we could state that some POES methods have higher correlations with Emotional Expressions than hand scoring does.

We wanted to determine which of the POES scoring methods had the highest correlations with the criterion variables. Because the LEAS-C was not computer-administered, it was not possible to calculate the 3345 method. Of the remaining three methods, the correlations for the 334 method were the most similar to the correlations for hand-scoring, as was expected. However, the Highest-4 method had consistently higher correlations than the other POES methods, and for Emotion Expressions this difference reached statistical significance. We conclude that the Highest-4 method has stronger validity evidence than the other POES methods.

Conclusions

A growing body of evidence supports the validity and clinical relevance of the adult paper-based LEAS. This has inspired the development of alternative forms of the LEAS: a child form and a computerized form. However, LEAS hand scoring is time-consuming. Lane et al. (1990) recommended automating the LEAS, which would greatly reduce scoring time. The purpose of this study was to examine the usefulness of our attempt to automate the scoring of these alternative versions of the LEAS. The results were highly encouraging. Computer scoring resulted in high internal consistencies and high correlations with hand scoring. Computer scoring also resulted in moderate correlations with Emotion Expressions, Emotion Comprehension and Vocabulary.

These results indicate that computer scoring and hand scoring are tapping the same general construct and that computer scoring may be used instead of hand scoring in some contexts. This could facilitate the measurement of Emotional Awareness in applied settings, where clinicians, educators, and Human Resource personnel may not have time to learn the hand scoring method. Although it is possible to convert hand-written LEAS responses to computer-typed responses, this takes approximately the same length of time as hand scoring the LEAS responses. Because of this, computer scoring will only save time if respondents do their own typing. Therefore, future research should also examine different formats for the computer-administered LEAS, and should then select a single standardized format for computer administration.

Some differences were found between the four computerized scoring methods. The 334 and 3345 methods had the highest correlations with hand scoring, as expected. Of these two, the 3345 method had a higher correlation with hand scoring and higher

internal consistency and therefore is preferred. If researchers or applied psychologists are trying to select a computerized scoring method that is as similar as possible to the well-validated hand scoring method, then the 334 or 3345 methods should be used. If the data have been collected with separate areas for responses to the questions "How would you feel?" and "How would the other person feel?", it is possible to calculate the 3345 method. If the data have been collected with both of these questions at the top and then one area for responses (as is the case in the original paper-based adult LEAS and the paper-based LEAS-C), then only the 334 method can be calculated.

On the other hand, the Highest-4 and All-Sum methods had higher internal consistencies and higher correlations with Emotion Expressions. Of these two, the Highest-4 method had a significantly higher correlation with hand scoring and with Emotion Expressions, and is therefore preferred. Therefore, if a researcher or applied psychologist is trying to select the computerized scoring method with the greatest validity evidence, the Highest-4 method is recommended at this time.

Additional validity studies are needed to replicate and extend these findings. Only a limited number of criterion variables have been examined at this point, and in some cases the differences between the POES scoring methods were not statistically significant. Therefore, more research is needed to determine which POES method is to be preferred for each version of the LEAS and for any particular research or applied setting. Unless there is a compelling pragmatic or theoretical reason to avoid doing so, we recommend that researchers use all four POES methods until we have sufficient evidence to determine which method usually has the highest validity for each version of the LEAS.

Appendix A: Hand Scoring

When hand scoring the LEAS, item scores are calculated in three stages (Lane, 1991). First, each word in the response is assigned a score. Non-emotion words (e.g., aware, expect) are scored 0. Physiological sensations (e.g., dizzy, tired) are scored 1. Words that indicate emotions but also have non-emotional meanings (e.g., bad, fine) are scored 2, as are actions related to emotions (e.g., cry, smile), and personality traits (e.g., kind, tolerant). Discrete emotion words (e.g., love, fear) are scored 3. The scoring manual glossary (Lane, 1991) lists words and phrases and their associated levels. However, the glossary is not exhaustive: the scorer often has to look for synonyms, or consult the rules regarding the types of words included at each level.

The second stage is to calculate self and other scores. To do this, the scorer decides if each emotion word is attributed to the self or to the other person. For example, in the statement "I would be so happy my love was reciprocated", who feels "love" – the self, the other, or both? The scorer also has to decide if emotion words are synonymous: is "love" the same as "care for"? Based upon these two subjective judgments, the scorer calculates the self and other scores. If the response has two non-synonymous Level 3 emotion words attributed to the self, the self score is 4. If not, the self score is the maximum of the word scores for emotions attributed to the self. The other score is calculated analogously, based upon emotions attributed to the other person.

The third stage is to calculate the item score. If self and other scores are both 4 and the emotions for self and other are different, the item score is 5. Otherwise, it equals the maximum of the self and other scores. This results in item scores that range from 0 (no emotion words) through 5 (combinations of blends of emotions), corresponding to the six levels of Emotional Awareness in the Lane and Schwartz (1987) model. Total test scores are calculated as the sum of the item scores for the 20 items.

Appendix B: POES Scoring

To score the LEAS, POES 1.2.2 (Leaf & Barchard, 2006) requires two input files: the participants' typed response data and a Wordlist file that specifies the score values to be given for specific words and phrases. Currently, there are two versions of the LEAS Wordlist. The initial version, LEAS Wordlist 1.0 (Leaf & Barchard, 2002), was based directly upon the LEAS hand-scoring manual (Lane, 1991). The major challenge in translating the LEAS glossary into the LEAS Wordlist 1.0 was handling words with multiple values. When the LEAS glossary gave only a single value for a word, then that value was entered in LEAS Wordlist 1.0. In some cases, however, a glossary word has two values depending upon context. For example, "hurt" could be Level 1 if it refers to a physical sensation or Level 3 if it describes an emotion. Because POES 1.2.2 cannot make distinctions based upon context, each Wordlist entry must be associated with only a single value. For multi-valued glossary words, a team of experienced LEAS scorers discussed which interpretation was most common, and decided which value would be used in the Wordlist. The LEAS Wordlist 1.0 contained 888 word and phrase entries. The main limitation of this original Wordlist was that it did not contain words and phrases that were nearly identical to LEAS glossary entries.

Wordlist 2.1 (Barchard, 2006) expanded the list of words and phrases that received scores. A team of five expert LEAS scorers considered 467 possible additions and modifications. The changes fell into five categories. First, if an LEAS glossary entry included a pronoun, additional entries were added for all remaining pronouns. Second, if an LEAS glossary entry did not include the most common way of phrasing an idea, the most common phrasing was added. Third, when an entry included a verb, alternative verb tenses were added. Fourth, when an entry included a word for which there are different forms, the other forms of the word were added (e.g., original entry "joy"; additional entry "joyful"). Fifth, if an entry included parenthetical material to clarify meaning, we separated the parenthetical and non-parenthetical material, and considered both as possible entries. Changes were made if four of the five expert scorers agreed that the change should be made. The final LEAS Wordlist 2.1 consists of 1242 word and phrase entries.

Once the participants' response data and the Wordlist file are specified, POES scores the data in three stages that are analogous to the three stages of LEAS hand scoring. First, POES scans each item response for words and phrases that occur in the Wordlist. These words and phrases are called valuables. Each valuable found in the response, along with its score value, is recorded in the Valuables List for that item. Next, POES calculates item scores using four different scoring methods (described below). Finally, for each scoring method, the item scores are summed to calculate the total test score. Each participant receives four total test scores, one for each scoring method.

POES 1.2.2 uses four methods of calculating item scores for the contents of the Valuables List. The first method, All-Sum, calculates the sum of all the values in the Valuables List for an item. This method is the most straightforward procedure and incorporates all of the information given in a response. Because of its simplicity and generality, All-Sum is the scoring method that is most applicable to scoring other open-ended tests, besides the LEAS.

The second method, Highest-4, calculates the sum of the four highest values in the Valuables List. For LEAS hand scoring, item scores are based upon four values: the two highest values for self and the two highest values for other. Highest-4 is a simplification of that idea. It looks at the four highest values, but ignores which person an emotion was attributed to.

The third method, 334, is like hand scoring in that it gives higher scores to responses that include multiple, distinct emotion words than to responses that use identical words or phrases repeatedly. Specifically, the 334 method searches the Valuables List for all valuables with a value of 3. If all contain the exact same word or phrase, then an item score of 3 is assigned. If any two of the valuables are not identical, then an item score of 4 is given. If there are no valuables with a value of 3, the item score is the maximum value found in the Valuables List.

The final scoring method, 3345, provides the best emulation of LEAS hand scoring. This method uses the separate text input boxes for the questions "How would you feel?" and "How would the other person feel?" on the computer-administered LEAS to distinguish between emotions attributed to self and other. However, this distinction is only an approximation to that made during hand scoring because LEAS responses often attribute emotions to self and other in the same sentence. There is no guarantee that participants entered only self-emotions in the "How would you feel?" box and other-emotions in the "How would the other person feel?" box.

The 3345 method calculates an item score in three steps. First, self and other Valuables Lists are created, based upon the responses in the two text input boxes. Next, these lists are scored separately, using the 334 method, to obtain self and others scores. Finally, the item score is calculated based upon the self and other scores: an item score of 5 is given if the self and other scores are both 4; otherwise, the item score is the maximum of the self and other scores.

The POES 1.2.2 scoring methods follow concrete algorithms and do not attempt to mimic any of the subjective judgments required for hand scoring. In particular, POES does not determine word meaning based upon context, does not consider synonyms, and does not actively try to decide whether an emotion is attributed to self or other. Thus, even the POES scoring methods that most closely mimic hand scoring only *approximate* human scoring.

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Table 1 *Internal Consistency*

Scoring Method	Coefficient Alpha[1]	
Sample 1 (Children), Paper LEAS-C		
POES Highest-4	.78**[a]	[.68, .86]
POES All-Sum	.76**[b]	[.65, .84]
POES 334	.60**[c]	[.41, .74]
Hand Scoring	.66**[bc]	[.51, .78]
Sample 2 (Adult Students), Computerized LEAS		
POES Highest-4	.91**[a]	[.88, .94]
POES All-Sum	.92**[a]	[.89, .94]
POES 334	.79**[b]	[.71, .86]
POES 3345	.86**[c]	[.81, .90]
Hand Scoring	.88**[c]	[.83, .92]

* $p < .05$. ** $p < .001$.

Note. 95% confidence intervals are given in brackets.

1. In these columns, coefficients with different superscripted letters were significantly different using $p < .05$.

Table 2 *Correlations of POES Total Scores with Hand-Scoring Total Scores*

POES Method	Correlation[1]		Correlation when Corrected for Attenuation[2]	
Sample 1 (Children), Paper LEAS-C				
Highest-4	.61**[a]	[.40, .76]	.65*	[.18, 1.02]
All-Sum	.61**[a]	[.40, .76]	.65*	[.18, 1.04]
334	.69**[a]	[.51, .81]	.84*	[.23, 1.34]
Sample 2 (Adult Students), Computerized LEAS				
Highest-4	.80**[a]	[.68, .87]	.87**	[.69, 1.01]
All-Sum	.76**[b]	[.64, .85]	.82**	[.61, .96]
334	.80**[a]	[.70, .88]	.97**	[.74, 1.13]
3345	.86**[c]	[.79, .92]	.98**	[.81, 1.10]

** $p < .001$.

Note. 95% confidence intervals are given in brackets.

1. Correlations with different superscripted letters are significantly different using $p < .05$ using Williams' (1959) T2 statistic.

2. These correlations were corrected for lack of internal consistency using a procedure recommended by Leonard Feldt (personal communication, March 8, 2006).

Table 3 *Correlations between LEAS-C and Criterion Variables – Sample 1 (Children)*

Criterion Variable Scoring Method	Correlations	
	R	R^2
Emotion Expressions		
POES Highest-4	.46**[a]	.21**
POES All-Sum	.40*[b]	.16*
POES 334	.29*[abc]	.09*
Hand Scoring	.15[c]	.02
Emotion Comprehension		
POES Highest-4	.29*[a]	.08*
POES All-Sum	.27+[a]	.07+
POES 334	.28*[a]	.08*
Hand Scoring	.28+[a]	.08+
Vocabulary		
POES Highest-4	.46**[a]	.21**
POES All-Sum	.44*[a]	.19*
POES 334	.38*[a]	.15*
Hand Scoring	.31*[a]	.09*

+ $p < .10$. * $p < .05$. ** $p < .001$.

Note. Correlations with different superscripted letters were significantly different using $p < .05$.