



Development and initial validation of the Literature Epistemic Cognition Scale (LECS)



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ABSTRACT

Learning and problem solving in the natural sciences and history is affected by epistemic cognition. Likewise, it has recently been proposed that the same is true for interpreting literature, although there is little empirical research on how individual differences in epistemic cognition for literary reading impact literary interpretation (Lee, Goldman, Levine, & Magliano, 2016). The development of a valid and reliable assessment of epistemic cognition for literature is an important step in examining this question. The present study takes a first step toward such a scale in that it reports the development of a scale that for assessing adolescents' epistemic cognitions for literary reading, the Literature Epistemic Cognition Scale (LECS). Results address the content validity, factorial validity, criterion validity, and reliability of the three constructs assessed on the LECS: relevance of literature to understand people and the human experience; openness of literary works to multiple meanings and interpretations; functionality of multiple readings of literary works for interpretation. The study involved a large sample of middle school students in the U.S. Confirmatory factor analysis validated the three-factor structure of the LECS. Criterion validity was established via correlational analyses between the subscale of the LECS and measures of the speed of acquiring knowledge, liking of reading, and frequency of reading as assessed through additional surveys. The implications of the results and directions for potential future research are discussed.

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1. Introduction

Research suggests that students' problem solving, learning, and reasoning about topics in the natural and social sciences are strongly related to epistemic cognition (Bråten & Strømsø, 2009; Conley, Pintrich, Vekiri, & Harrison, 2004; Heft & Nasar, 2000). Broadly speaking, epistemic cognition refers to knowledge and beliefs upon which people draw in trying to understand particular phenomena (Greene, Sandoval, & Bråten, 2016; Hofer, 2000; Hofer & Pintrich, 1997; Perry, 1970, 1981; Schommer, 1990). As Mason and Bromme (2010) note: "Epistemic

beliefs are facilitative for learning when these general ideas correspond to the knowledge which has to be learnt ... and to the task ..., or to the type of knowledge representation" (p. 3).

Various scales and questionnaires have been developed to measure epistemic cognition in the natural and social sciences but have been less common in the humanities, specifically for understanding literature. We conceptualize "understanding literature" (and equivalent phrases "response to literature" and "literary reading") as involving basic comprehension (e.g., character, plot) plus interpretative inferences about the messages or morals that can be derived from a literary work (Goldman, McCarthy, & Burkett, 2015). As such, understanding literature is an open-ended, complex problem solving task similar in many regards to ill-defined problems in other domains (Lee & Goldman, 2015; Lee, Goldman, Levine, & Magliano, 2016). For this reason we might also expect that individual differences in epistemic cognition for literature would relate to student outcomes just as they do in the natural and social sciences.

Exploring the relationship of epistemic cognition and literary reading requires the development of valid and reliable assessments of

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epistemic cognition about literature. This paper reports on the development of a survey instrument that reflects a first step in this direction, the Literature Epistemic Cognition Scale (LECS). The development of the LECS was based on conceptualizations of literary reading (Goldman et al., 2016) and a conceptual analysis of epistemic cognition as instantiated in literary comprehension and interpretation (Lee et al., 2016). We intended this instrument for use with adolescent readers. As such it does not encompass the epistemic cognition of all literary reading. Rather it examines three constructs deemed important for readers in this developmental range: relevance to life of reading literary works; literary works may have multiple meanings; understanding literature involves reading a literary work multiple times.

1.1. Conceptualizations of epistemic cognition

Hofer and Pintrich (1997) and Hofer (2000) argued that there were two central aspects of epistemic cognition: (1) the nature of knowledge, and (2) the nature of knowing. They described two continual relevant to the nature of knowledge: (1) simplicity to complexity, and (2) certainty to uncertainty. The nature of knowing referred to beliefs about how knowledge is generated (sources of knowledge) and how knowledge claims are justified. Individual differences on these dimensions have been found to be related to learning from text. For example, students who think that knowledge is simple tend to learn less information during reading than those who believe that knowledge construction is complex and takes time to acquire (Pieschl, Stahl, & Bromme, 2008; Schommer, Calvert, Garigletti, & Bajaj, 1997). Readers who assume that knowledge takes time to acquire tend to look for multiple sources of information to justify a position when learning about a topic than do readers who assume that knowledge can be acquired quickly (Bråten & Strømsø, 2006; Pieschl et al., 2008).

Chinn, Buckland, and Samarapungavan (2011) proposed an expanded conceptualization of epistemic cognition. They argued that the nature of knowledge and the nature of knowing do not adequately encompass epistemic cognition, particularly for complex and ill-defined problems. They postulated a network of interrelated dimensions of epistemic cognition that are entailed in what people do as they seek to solve problems: (1) *epistemic aims and values* – the goals people have and the worth placed on problems they seek to interrogate; (2) *the structure of knowledge* – viewing knowledge as simple or complex, and attention to particular epistemic structures (e.g., “people’s understanding of microbiological mechanisms” Chinn et al., 2011, p. 142); (3) *sources and justifications of knowledge, including attitudes and stances toward knowledge* (e.g., tentative versus static); (4) *epistemic virtues and vices* – dispositions that can either aid or constrain achieving one’s problem solving goals (e.g., taking risks or pushing boundaries); (5) *reliable and unreliable processes for achieving goals* – these include cognitive and social processes that one believes best assist in achieving the desired goals. This multi-dimensional conceptualization of epistemic cognition opens a broader window through which to interrogate the micro-level processes and resources on which people draw especially to address complex, and ill-define problems.

Building on the work of Chinn et al. (2011), Lee et al. (2016) proposed a multidimensional framework to depict epistemic cognition for literary understanding. This framework reflects a synthesis of theory and research across multiple disciplines relevant to understanding literature, including reading comprehension, literary theory and criticism, language processing, psychological research on narrative, and social cognition. Particularly informative were expert-novice studies of literary reasoning. We cannot reiterate that argument in its entirety in this paper. Rather we summarize the conceptual basis for the constructs that constitute the LECS, drawing on the five dimensions put forth by Chinn et al. (2011).

1.1.1. Epistemic cognition in understanding literature

Response to literature ideally involves people pursuing goals and aims related to interrogating dilemmas of the human experience and placing value on relationships between textual content and form as well as relations across texts (Lee et al., 2016). In terms of the structure of knowledge, literary reasoning and theorizing is complex, involving multiple dimensions, and consideration of context. Claims about literature should reflect an appreciation of literary texts as open to multiple interpretations. Interpretations reflect sources and justifications of knowledge that derive from personal knowledge and beliefs (e.g., philosophical, religious, political), literary and language conventions, other texts and knowledge of authors. Thus, literary reasoning benefits from dispositions to tolerate uncertainty and ambiguity, and to attend to nuances of language choices, language play, and structure of language. Arguments about possible meanings can be justified based on these types of textual evidence. Finally, processes employed to achieve the goals involve close reading of text, attention to patterns that emerge across words, sentences, and larger structures of a text, and consideration of multiple interpretations that might be entertained.

The three constructs tapped by the LECS derive from the foregoing characterization of literary reading. *Relevance to life* captures one set of epistemic aims and values, specifically, the belief that reading literature can provide us with insights into human behavior, both our own and others. Humans inherently seek to understand why we and others behave the way we do (e.g., Hastie, 1983). Narratives play a functional role in how human beings make sense of experience in the world (Bruner, 1990; Turner, 1996). Moreover, a fundamental assumption of the field of literary studies is that one reads literature with goals of exploring the human condition (Hynds, 1989; Smagorinsky & Phelan, 1990). *Multiple meanings* capture epistemic virtues and vices, namely the disposition to appreciate literary texts as open to multiple interpretations. Literary texts entail language that is inherently subject to multiple meanings (Ortony, 1979; Ricoeur, 1978), including figuration (e.g., metaphor, symbolism, irony, satire, unreliable narration) along with rhetoric and structure to represent multi-dimensional characters and complex chronologies (Hillocks & Ludlow, 1984; Levine & Horton, 2013; Peer, Hakemulder, & Zyngier, 2007; van den Broek, 1996). *Multiple readings* capture reliable and unreliable processes. Literary criticism values multiple readings by individual critics and of the same text across communities of readers (Frye, 1970; Hart, 2001). Expert readers of literature recognize the importance of multiple readings, whereas novices are less likely to do so (Graves & Frederiksen, 1996; Peskin, 1998). Studies of effective literature teaching for adolescents document the value of teaching students to engage in multiple readings of the same text within and across classes over time (Lee, 2011; Wolf, 1995). Thus we argue there is substantive research from across studies of literary theory, literary criticism, metaphor comprehension, and narrative sense-making to warrant that these three constructs are central to, although not exhaustive of, the knowledge, beliefs, and dispositions that are valued in this domain.

1.2. Present study

This paper reports the development of the three-construct LECS to measure adolescents’ epistemic cognitions about literature. We briefly discuss its evolution from a five- to a three-construct scale and then go into greater depth on the assessment of the content validity, factorial validity, criterion validity, and reliability of the three-construct LECS.

Preceding this study, we had attempted to derive a five-construct scale that in addition to multiple meanings, relevance to life, and multiple readings tapped beliefs about reflection on literary works and about how authors use language to convey their message (Yukhymenko et al., 2014). However, exploratory factor analysis revealed the presence of three distinct factors corresponding to multiple meanings, relevance to life, and multiple readings. Items intended to tap the other two factors did not cluster as anticipated. Examination of these items suggested

that adolescents may not have been sensitive to the dimensions these items were intended to tap. Alternatively, they may not have interpreted the items in ways that were sufficiently different from interpretations of items intended to tap other constructs. It is also possible that adolescents may not have regarded these items as relevant to reading literature.

Given that three of the five initial constructs did emerge, we decided to pursue the validation of the three-construct LECS as an initial strategy for surveying adolescents' epistemic cognition for understanding literature. Factorial validity was examined by exploring the factor structure of the LECS and testing measurement invariance for gender and grade band (middle and high school). Testing for equivalence of measures allows checking whether members of different groups ascribe the same meaning to items of the scale, thus, providing evidence of factorial validity (Estabrook, 2012; Muthen & Muthen, 1998–2010; Netemeyer, Bearden, & Sharma, 2003).

Criterion validity was examined by exploring relationships between the scores on the LECS and the Speed of Knowledge Acquisition subscale from the Wood and Kardash (2002) epistemology scale. Because the speed of knowledge acquisition measures beliefs about quick learning (ranging from a naïve view that learning is a quick and straightforward process to a more sophisticated view that learning is a complex and gradual process), we predicted that speed of knowledge acquisition would be correlated with the multiple meaning and multiple reading subscales of the LECS. Additionally, we examined relationships between reading habits and the scores on the LECS. Students who read more tend to find reading more enjoyable, and thus tend to be better readers than students who do not (Stanovich, 1986). Moreover, students benefit from reading even when reading for pleasure outside of the classroom (Mol & Bus, 2011). Therefore, we predicted that higher ratings on "like to read outside of schoolwork" item and higher ratings on time spent reading outside of school would be associated with more positive ratings on all three of the epistemic cognition constructs.

2. Methods

2.1. Participants

Participants were 798 student (53.5% female) from 47 classrooms in four middle ($n = 455$, 57.1% of the total sample, 11–15 years of age, $M = 13.2$, $SD = 0.95$) and four high schools ($n = 343$, 42.9% of total sample, 13–18 years of age, $M = 16.1$, $SD = 1.27$) located in a district adjacent to a large urban Midwestern area. Race-ethnicity self-identification was 33.4% Hispanic or Latino, 24.1% White, 21.4% Asian, 6.9% Black or African American, 1.6% American Indian or Alaska Native, 0.9% Native Hawaiian or Pacific Islander, and 11.7% "other" or multiethnic. Gender was evenly distributed across the middle and high school grades, $\chi^2(1, n = 796) = 1.18$, $p = 0.283$.

2.2. Measures

2.2.1. Literature Epistemic Cognition Scale

A version of LECS was tested in a pilot study and originally had 37 items to measure three subscales: (1) 14 items for the multiple meaning; (2) 13 items for the relevance to life; and (3) 10 items for the multiple reading. Following recommendations in scale development literature (DeVellis, 2012; Polit, Beck, & Owen, 2007; Rubio, Berg-Weger, Tebb, Lee, & Rauch, 2003), the items were submitted for content validation to a group of content experts in literature to evaluate the construct category for each item, certainty of placing each item under the specified category, and the relevance of the item to the corresponding construct. Responses provided by the experts were then used to generate a factorial-validity index (FVI, Rubio et al., 2003) for each construct category and an item-level content validity index (I-CVI, Polit et al., 2007) for certainty and relevance. These metrics were examined for each item to decide whether each individual item would be

retained in the scale. The cut-off values for the FVI and I-CVI were set at 0.85 allowing one disagreement among the experts.

Based on the FVI and I-CVI, eight items were deleted and two items were reworded resulting in a 29-item scale, designed to measure multiple meaning (10 items), multiple reading (9 items), and relevance to life (10 items). Lastly, scale-level content validity indices (S-CVI, Polit et al., 2007) were computed for each construct with the final set of items using the averaging approach. The values of S-CVI for relevance were 1.0 for multiple meaning, 0.93 for relevance to life, and 0.98 for multiple reading, indicating excellent content validity of the final set of items. The 29 items were tested with a sample of middle and high school students in the present study.

The multiple meanings and relevance to life subscales consisted of all positively worded items so that higher scores reflected more sophisticated beliefs. The multiple readings subscale consisted of all negatively worded items with higher scores reflecting less sophisticated beliefs. For analyses, the ratings on the multiple reading items were recoded so that higher scores reflected more sophisticated beliefs.

2.2.2. Speed of knowledge acquisition

To assess criterion validity of the LECS, students also completed the speed of knowledge acquisition subscale from the Wood and Kardash (2002) epistemology scale. Students indicated their agreement from 1 (*strongly disagree*) to 5 (*strongly agree*) for seven items (e.g., *Almost all the information you can understand from a textbook you will get during the first reading*). In analyzing these data, Wood and Kardash (2002) reverse code the ratings so that higher scores indicate the more sophisticated view that learning is a complex and gradual process. We followed the same recoding procedure in analyzing the data.

2.2.3. Reading habits

Participants were asked to answer two additional questions evaluating their liking (i.e., *How much do you like reading outside of schoolwork*) with three response options, 1 (*not at all*), 2 (*somewhat*), and 3 (*a lot*), as well as frequency of reading (i.e., *Compared to your peers, how much time do you spend reading outside of schoolwork*) with three response options, 1 (*less time*), 2 (*as much time*), and 3 (*more time*).

2.3. Data analysis

To analyze the data, we stratified across gender and grade band (middle and high school) and randomly divided the 798 surveys into split-half samples. One subsample served as the primary developmental sample, and the other was used to cross-check the findings (DeVellis, 2012). The analyses were performed using Mplus 6.12 (Muthen & Muthen, 1998–2010). Sample 1 ($n = 399$) was used to perform a confirmatory factor analysis (CFA) to test the factorial structure of the scale, optimize its length by reducing the number of items that were redundant or that threatened the dimensionality of the scale, and assess its factorial validity and reliability. Several indices were used to evaluate model fit, including chi-square index, root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), comparative fit index (CFI), and Tucker–Lewis index (TLI). We examined chi-square to degrees of freedom ratio, which is considered a good fit if it is <2.0 . Values of SRMR and RMSEA <0.08 , and values of CFI and TLI >0.90 indicate a reasonable fit, while a value of RMSEA <0.06 and values of CFI and TLI >0.95 are required for a relatively good fit (Hu & Bentler, 1999). We also examined item loadings, modification indices, latent correlations, and omega reliability (McDonald, 1970). Item loadings should be significant and be at least 0.40; high modification indices may be a result of high correlations between measurement errors indicating cross-loadings or wording redundancy; high correlations between the factor scores indicate multicollinearity and may potentially distort parameter estimates or suggest that the model has too many factors; and omega reliability reflects the ratio of true

score variance to total variance and is interpreted similarly to Cronbach's alpha.

Sample 2 ($n = 399$) was used to perform CFA and structural equation modeling (SEM) to confirm the factorial structure of a refined scale identified with Sample 1, and to further establish its factorial validity and criterion validity. Factorial validity was examined through tests of measurement invariance for equality of factor patterns, factor loadings, and factor variances across middle and high school students as well as males and females. Before testing for measurement invariance, baseline models were established for each subgroup, specifically, (a) across grade band for middle and high school students, and (b) across gender for males and females. Then, a sequence of progressively restrictive models was tested for equality of factor patterns, loadings, and intercepts. The models were compared based on changes in fit indices, using cut-off scores of 0.15 on changes in RMSEA and 0.01 on changes in CFI and TLI (Chen, 2007; Cheung & Rensvold, 2002). Factorial invariance is demonstrated when progressively restrictive models do not significantly change the fit of the model compared to the previous model as indicated by changes in RMSEA, CFI, and TLI. Criterion-validity was examined based on latent correlations of the SEM model. The model included three latent variables of literature epistemic cognition and their corresponding observed items, a latent variable of speed of knowledge acquisition and its corresponding observed items, and two single indicator latent variables, specifically, liking of reading and reading frequency.

3. Results

3.1. Sample 1

Missing values ranged from 0 to 2.3% and were within the recommended norms (Fichman & Cummings, 2003). Mardia's (1970) measure for multivariate kurtosis indicated that data were not normally distributed ($518.5, p < 0.001$), therefore a maximum likelihood estimation with robust standard errors was used. The 29 items were specified as indicators of their intended factors of multiple meanings, relevance to life, and multiple readings. The results showed inadequate model fit: $\chi^2(374, n = 399) = 822.2, p < 0.001$ ($\chi^2 / df = 2.20$), CFI = 0.892, TLI = 0.882, RMSEA = 0.055, 90% CI [0.050, 0.060], SRMSR = 0.068. Items that could threaten the dimensionality of the scale or were redundant were revealed based on high values of modification indices and these items were removed in a series of CFAs. A three-factor 16-item model reflecting five items for multiple meaning, five items for relevance to life, and six items for multiple reading showed a good fit: $\chi^2(101, n = 399) = 128.4, p = 0.034$ ($\chi^2 / df = 1.27$), CFI = 0.984, TLI = 0.981, RMSEA = 0.026, 90% CI [0, 0.039], SRMSR = 0.041. Modification indices did not suggest any further changes to the model. All

item loadings were significant (see Table 1). Omega reliabilities were reasonable: 0.79 for multiple meaning, 0.85 for relevance to life, and 0.89 for multiple reading. The latent correlations among the factors were $r(397) = 0.30, p < 0.001$ for multiple meaning and relevance to life; $r(397) = 0.43, p < 0.001$ for multiple meaning and multiple reading; and $r(397) = 0.34, p < 0.001$ for relevance to life and multiple reading.

3.2. Sample 2

3.2.1. Confirmatory factor analysis

The 16 items were specified as indicators of their intended factors of multiple meaning, relevance to life, and multiple reading. Results indicated a good model fit: $\chi^2(101, n = 399) = 124.3, p = 0.058$ ($\chi^2 / df = 1.23$), CFI = 0.987, TLI = 0.985, RMSEA = 0.024, 90% CI [0, 0.037], SRMSR = 0.035. Table 1 presents item loadings, which all were significant (see Sample 2). Omega reliabilities were 0.79 for multiple meaning, 0.85 for relevance to life, and 0.89 for multiple reading, indicating reasonable reliabilities of the subscales.

3.2.2. Factorial validity

Table 2 shows the fit indices for the models testing for measurement invariance across grade band and gender. The scale was invariant across grade band and gender as indicated by changes of < 0.15 in RMSEA and < 0.01 in CFI and TLI. Thus, factorial validity was established by demonstrating reasonable fit indices that did not change substantially across the models measuring invariance of factor pattern, loadings, and variances, suggesting an enhanced generalizability of the LECS showing that the scale is valid for middle and high school students as well as for both genders (Netemeyer et al., 2003).

3.2.3. Descriptive statistics

Mean scores were computed for multiple meaning, relevance to life, and multiple reading by averaging their corresponding items. Likewise, a scale score was computed for *speed of knowledge acquisition* subscale. Table 3 shows descriptive statistics for the literature epistemic cognition subscales (i.e., multiple meanings, relevance to life, and multiple readings) and speed of knowledge acquisition, as well as students' liking of reading and frequency of reading by grade band and gender. Mean values showed that, on average, students "agreed" that a literary work has several different possible meanings, had more neutral beliefs about whether literature is relevant to life by providing example scenarios that readers can apply to their lives, and reported that multiple readings of a literary work were effective to fully understand it.

Table 1

Standardized factor loadings and standard errors for the final 16-item model in study 2.

| Subscale | Items | Sample 1 ($n = 399$) | | Sample 2 ($n = 399$) | |
|----------|---|------------------------|------|------------------------|------|
| | | Estimate | SE | Estimate | SE |
| MM | A piece of literature can have several possible meanings | 0.77 | 0.04 | 0.71 | 0.05 |
| MM | Different people can see different messages in a piece of literature | 0.56 | 0.06 | 0.57 | 0.06 |
| MM | One piece of literature can be interpreted in more than one way | 0.66 | 0.06 | 0.69 | 0.05 |
| MM | The meaning of a piece of literature is different for each person who reads it | 0.59 | 0.05 | 0.60 | 0.05 |
| MM | The same piece of literature can have different meanings to different readers | 0.70 | 0.05 | 0.70 | 0.04 |
| RL | The more I read, the more I understand other people | 0.76 | 0.03 | 0.79 | 0.03 |
| RL | Reading literature helps me understand why people act the way they do | 0.73 | 0.04 | 0.77 | 0.03 |
| RL | Reading literature helps me appreciate the way other people see the world | 0.72 | 0.04 | 0.75 | 0.04 |
| RL | Literature helps me value another person's point of view | 0.76 | 0.03 | 0.72 | 0.04 |
| RL | I can better understand the behaviors of my friends because I read | 0.67 | 0.04 | 0.64 | 0.04 |
| MR | Reading the same piece of literature again is useless | 0.85 | 0.03 | 0.90 | 0.02 |
| MR | Re-reading the same piece of literature is meaningless | 0.82 | 0.03 | 0.84 | 0.03 |
| MR | Re-reading a piece of literature is a waste of time because I already know the ending | 0.85 | 0.03 | 0.83 | 0.03 |
| MR | I do not learn anything new when I read the same piece of literature again | 0.68 | 0.04 | 0.73 | 0.04 |
| MR | There is no point in re-reading something you have already read before | 0.75 | 0.04 | 0.69 | 0.05 |
| MR | I do not understand why people read their favorite books multiple times | 0.52 | 0.05 | 0.59 | 0.05 |

Table 2
Model fit indices for tests of measurement invariance by grade band and gender.

| Model | χ^2 | df | χ^2 / df | RMSEA | CFI | TLI |
|----------------------------|----------|-----|---------------|-------|-------|-------|
| Grade band | | | | | | |
| Middle school, $n = 227$ | 115.4 | 101 | 1.14 | 0.025 | 0.987 | 0.984 |
| High school, $n = 172$ | 139.5** | 101 | 1.38 | 0.047 | 0.957 | 0.949 |
| Model 1 (factor pattern) | 255.8** | 202 | 1.27 | 0.037 | 0.972 | 0.967 |
| Model 2 (factor loadings) | 265.3* | 215 | 1.23 | 0.034 | 0.974 | 0.971 |
| Model 3 (factor variances) | 319.5*** | 244 | 1.31 | 0.039 | 0.961 | 0.962 |
| Gender | | | | | | |
| Males, $n = 187$ | 116.1 | 101 | 1.15 | 0.028 | 0.985 | 0.982 |
| Females, $n = 211$ | 102.5 | 101 | 1.01 | 0.008 | 0.998 | 0.998 |
| Model 1 (factor pattern) | 218.3 | 202 | 1.08 | 0.020 | 0.991 | 0.990 |
| Model 2 (factor loadings) | 235.0 | 215 | 1.09 | 0.022 | 0.989 | 0.988 |
| Model 3 (factor variances) | 255.0 | 244 | 1.05 | 0.015 | 0.994 | 0.994 |

Note. RMSEA = root mean square error of approximation; CFI = comparative fit index; TLI = Tucker–Lewis index.

* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

3.2.4. Criterion validity

To estimate measurement and structural components of the first model, the 16 items were specified as indicators of their intended factors of multiple meaning, relevance to life, and multiple reading; seven items were specified as indicators of speed of knowledge acquisition; and two items were specified as single indicator latent variables of liking of reading and reading frequency. The model showed an adequate fit to the data: $\chi^2(262, n = 399) = 388.81, p < 0.001$ ($\chi^2 / df = 1.48$), CFI = 0.954, TLI = 0.947, RMSEA = 0.033, 90% CI [0.027, 0.042], SRMSR = 0.047. Factor loadings for each item were significant. Table 4 shows latent correlations among the variables. As expected, speed of knowledge acquisition was positively correlated with multiple reading, $r(397) = 0.49, p < 0.001$, and multiple meaning, $r(397) = 0.50, p < 0.001$. Also as predicted, liking of reading was positively correlated with multiple reading, $r(397) = 0.52, p < 0.001$, relevance to life, $r(397) = 0.44, p < 0.001$, and multiple meaning, $r(397) = 0.32, p < 0.001$. Similarly, self-reported frequency of reading was positively correlated with multiple reading, $r(397) = 0.36, p < 0.001$, relevance to life, $r(397) = 0.21, p < 0.001$, and multiple meaning, $r(397) = 0.17, p = 0.006$.

4. Discussion

The goal of this study was to test the factor structure and criterion validity of the LECS, as an initial assessment of individual differences in epistemic cognition for understanding literature. The results indicated that the LECS is a valid measure of epistemic cognition for literature in two senses: first, the CFA results confirmed the hypothesized three-construct factor structure of the scale both across grade bands and gender. Criterion validity was established in that there was support for the prediction of positive correlations of subscale scores for the constructs multiple meanings and multiple readings with the speed of knowledge acquisition scale. That is, students who reported higher valuing of

Table 3
Descriptive statistics for the measured variables for sample 2 by grade band and gender, $n = 399$.

| Variables | Range | Total | Middle school | High school | Males | Females |
|--------------------------------|-------|-------------|---------------|-------------|-------------|-------------|
| | | M (SD) | M (SD) | M (SD) | M (SD) | M (SD) |
| Multiple meanings | 1–5 | 4.24 (0.62) | 4.19 (0.63) | 4.31 (0.60) | 4.15 (0.64) | 4.32 (0.58) |
| Relevance to life | 1–5 | 3.29 (0.86) | 3.38 (0.87) | 3.16 (0.84) | 3.22 (0.88) | 3.34 (0.84) |
| Multiple readings ^a | 1–5 | 3.92 (0.94) | 3.95 (0.95) | 3.89 (0.93) | 3.71 (1.02) | 4.12 (0.82) |
| Speed of knowledge acquisition | 1–5 | 3.61 (0.63) | 3.51 (0.65) | 3.73 (0.58) | 3.53 (0.62) | 3.67 (0.63) |
| Like reading | 1–3 | 2.04 (0.62) | 2.10 (0.59) | 1.97 (0.64) | 1.87 (0.59) | 2.19 (0.60) |
| Frequency of reading | 1–3 | 1.90 (0.74) | 1.98 (0.68) | 1.80 (0.81) | 1.71 (0.69) | 2.07 (0.75) |

^a All negatively worded; means are based on re-coded values.

Table 4
Latent correlations for the measured variables for sample 2, $n = 399$.

| Variables | 1 | 2 | 3 | 4 | 5 |
|-----------------------------------|---------|---------|---------|---------|---------|
| 1. Multiple meanings | – | | | | |
| 2. Relevance to life | 0.39*** | – | | | |
| 3. Multiple readings | 0.46*** | 0.42*** | – | | |
| 4. Speed of knowledge acquisition | 0.50*** | 0.12 | 0.49*** | – | |
| 5. Like reading | 0.32*** | 0.44*** | 0.52*** | 0.28*** | – |
| 6. Frequency of reading | 0.17** | 0.21*** | 0.36*** | 0.24*** | 0.56*** |

* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

multiple meanings and multiple readings were also more likely to report that knowledge is complex and cannot be acquired quickly and easily. In addition, each of the subscales was positively correlated with ratings of liking reading and reading outside of school, reading habits that tend to be related to academic outcomes (Moje, Overby, Tysvaer, & Morris, 2008). These findings are consistent with those of Mason and Bromme (2010) that epistemic knowledge and beliefs facilitate learning and undergird metacognitive activity.

While some have argued that epistemic cognition may be domain general (e.g., Perry, 1970, 1981) or generally applied to reading literacy (Schraw & Bruning, 1996), the present study is consistent with the growing literature contending that epistemic cognition is discipline-, domain-, and even topic-specific (Bråten & Strømsø, 2009; Conley et al., 2004; Heft & Nasar, 2000). A fundamental premise of Lee et al.'s (2016) epistemic cognition framework for literature, which captures the conceptual grounding of the LECS, is that interpreting literature constitutes an open-ended, problem-solving task that requires an epistemic stance very different from disciplines in which there are objectively contestable solutions to problems. As indicated in the introduction, the LECS subscales reflect several of Chinn et al.'s (2011) expanded dimensions of epistemic cognition: epistemic aims and values (relevance to life), epistemic virtues and vices (multiple meanings), and reliable and unreliable processes (multiple readings). In future work on literary epistemic cognition, the dimensions identified in this study need to be explored more deeply and the scale needs to be expanded to include all five of Chinn et al.'s dimensions.

Because development of a scale is a cumulative and continuous process (DeVellis, 2012), we note several limitations. First, while the three dimensions and subscales identified in this study reflect important teaching goals in the context of middle and high school teaching, other dimensions and constructs that were not identified in this study may exist (Muis, Bendixen, & Haerle, 2006). Second, the work to date used methods rooted in classical test theory. Future studies might further explore the validity of the scale applying principles of the Rasch measurement model, a technique that can investigate and optimize the number of response scale points (Smith, Wakely, De Kruijff, & Swartz, 2003). Finally, both the cross-sectional design and the limited adolescent age range prevent inferences regarding changes across time in of epistemic beliefs about literary comprehension. The LECS's relevance, validity, and reliability in other populations and over wider age spans remain to be established. Questions of change and

development of epistemological beliefs have been central to the research in this field (e.g., Conley et al., 2004; Kuhn, 1991; Perry, 1970). It would be informative for future studies to investigate developmental trajectories of epistemic beliefs about literary comprehension in relation to instruction in literary reading as well as socio-emotional development.

Despite these limitations the LECS constitutes the first instrument to conceptually describe epistemic cognition constructs for response to literature. The effort reported here contrasts with broader, more diffuse reader surveys about strategies and dispositions for reading literature (e.g., Miall & Kuiken, 1995; Purves, 1973; Purves, Harnisch, Quirk, & Bauer, 1981). Importantly, the LECS in its relationship to more widely used frameworks for epistemic cognition connects with studies of the role of epistemic cognition in other disciplines. It thus creates the potential over time to extrapolate the potential and constraints of particular dimensions of epistemic cognition that may generalize across disciplines or may characterize a reliable starting set of orientations for novices.

In addition, the development of LECS is a critical first step in the systematic study of how an epistemic cognition for literature affects how children respond to literature in and outside academic contexts. An important goal of language arts education is to give students a sense of agency in how they interpret literature and how to support their interpretation with information drawn from the texts in question (Lee et al., 2016). The LECS should facilitate future research in understanding how dimensions of epistemic cognition for literature can facilitate or impede that agenda. One interesting issue for future exploration is the development of expertise in literary interpretation that informs how readers distinguish among and evaluate different points of view and interpretations. Valuing differences and multiple points of view is one important and foundational stance, but is not sufficient for evaluating such differences. This is a challenge in the broad field of epistemic cognition (e.g., in shifts from views of knowledge as simple and certain to knowledge as complex, constructed and contested). This area is particularly interesting in a domain like literature. Knowledge construction in all domains is a contestable process (Kuhn, 2012). In science and mathematics, for example, existing knowledge may be challenged and undergo revision when more complete and/or coherent theories or explanations for real world phenomena can be provided. Models that are explored in literature (human goals and internal states, morality, beauty, justice, courageous action, reflected in literary archetypal themes, etc.) may seem more inherently contestable and contextualized than those in science. However, it is important to realize that there are constraints on literary interpretations. Thus a focus in new work on both understanding developmental trajectories of such epistemic beliefs and knowledge in literature and implications for measuring such trajectories through scales such as what has been attempted in this work open up interesting and complex new directions.

In its present form, the LECS does assess important individual differences among middle and high school students' epistemic cognitions regarding relevance of literary reading to understanding other people and life more generally. The recognition of this function of literary reading may be important to encouraging adolescents to engage with canonical texts offered them throughout middle and high school even though many are drawn from distant time periods and places. Furthermore, appreciation for the multiple meanings and interpretations that a literary text may afford encourages students to shift from reading literary works in search of the "right" or "teacher-determined" answer to more active exploration and inquiry into interpretive meanings of literary works (see Sosa, Hall, Goldman, & Lee, 2016). In general, the more we understand about students' epistemic cognition about understanding literature, the more likely we are to successfully facilitate experiences reading and reasoning in the literature classroom that transfer into adolescents' everyday lives.

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