Knowledge-Linking Perceptions of Late-Elementary Students

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This study describes student perceptions of potential elaborative or generative learning strategies called student knowledge links. This construct was assessed using the Student Knowledge Linking Instrument-Perceptions (SKLIP), a new learning inventory to measure late-elementary student perceptions of the creation of student knowledge links. After conducting two pilot studies, a total of 469 fifth- and sixth-grade students participated in the field study. With an internal reliability of α = .80, this 13-item instrument included three subscales: Seeking Relationships, School Learning across Time and Content, and Contextual Remindings. Post hoc analysis indicated that for some out-of-school links such as connections to people they know or places they have been, students try to determine if the link would be helpful in their learning. However, students who indicated making connections to TV shows or movies were also more likely to say they would then stop paying attention in class.

This study describes student perceptions of potential elaborative or generative learning strategies called student knowledge links (SKLs)—links between the content students are learning in class and what they already know. SKLs are often spontaneous, capturing what comes to mind when students receive information in school, and as such may be distracting for student learning. This study also describes student perceptions of a particular self-regulation skill in the linking process—do students stray in thought, or use the link as an opportunity to elaborate their learning?

The need for the Student Knowledge Linking-Perceptions (SKLIP), a new learning inventory to measure late-elementary student perceptions of the creation of SKLs, stemmed from a series of qualitative studies (Schuh, 2003, 2007) that described the often spontaneous connections that students made between content presented in their classrooms and their own prior experiences. Those studies were grounded in a constructivist view of learning; that learners construct their knowledge, using as a foundation what they already know or have experienced (e.g., Bransford, Brown, & Cocking, 1999; Bruning, Schraw, Norby, & Ronning, 2004; Derry, 1992; Jonassen, 1999; von Glasersfeld, 1995). Given that learning is an active construction process, there should be evidence in classrooms that students are indeed linking what they are currently learning to what they already know.

In those qualitative studies, it became apparent that students did indeed make such links. Therefore, a coding system of cues and trajectory dimensions was developed based on student data gathered through observation, interviews, and an open-ended writing activity. Cues were anything in the classroom that triggered learners' prior knowledge and thus captured the "sameness" between the new information and prior learning, such as "sounds like" or "same concept but different context." Trajectory dimensions captured where the prior learning took place and with whom (e.g., family, friends, school, society, media; see Schuh, 2003, 2004, 2007), reflecting students' integration of prior out-of-school learning with the content presented in school, as well as links connecting school content. Lemke (1997) hypothesized that the integration of out-of-school learning with school learning allowed for integrating personal trajectories with school practice, an integration that is often ignored. We describe here the background for the operationalizing of student knowledge links, including the development of the SKLIP, the results of the field study of the instrument, relationships between specific types of out-of-school links, and how students may regulate these in regards to in-school learning.

The SKLs identified in the previous studies indicated qualitative differences in the learning potential of links that students initially made with content (Schuh, 2004; Schuh, Wade, & Knupp, 2005). *Low-level links* included those that were tangential to the content (such as mentioning a weekend party on a boat when talking about the Vikings) or pointed to surface characteristics of the content. These links would not likely produce, even with exploration, a deeper understanding of the content (e.g., the Vikings captured Britain and France which linked with taking French for the first half quarter this year). Some *unelaborated links* could be potentially useful if the student's link was probed to prompt deeper understanding of the content (e.g., writing about the characteristics of Chinese culture, including their currency, and linking a father's trip to China and the money he spent). Finally, some students made and effectively described *deep links*. In this way, they indicated deep processing, augmenting what they were learning with what they already knew. For example, a student compared wealth and poverty in the Middle Ages with wealth and poverty now, based on multiple characteristics of each.

Deep links were useful for learning, indicating meaningful processing of information whereby students seek to relate, apply, and even theorize about what they learn (Alexander, 2003; Biggs, 1989, 1999; Marton & Säljö, 1976; Watkins, 1983). Deep links may indicate an understanding or an intention to understand (Biggs, 1999; Willingham, 2009), while processing content in a surface way limits understanding, directing attention to discrete or disconnected information (Watkins,1983) and memorizing for recall (Biggs, 1989, 1999; Marton & Säljö, 1976). While deep processing includes relating new information or text, for example, to prior knowledge (Murphy & Alexander, 2002; Willingham, 2009), the distinction here between surface and deep processing considers how relevant the prior knowledge may be when linked to what is to be learned, rather than if someone has deep or surface understanding of particular content being studied (Willingham, 2009).

The interplay between the level of processing and prior knowledge is tightly woven. Students who have deep knowledge of content are better able to interpret and understand content that may be linked with their prior knowledge (Willingham, 2009). Not all prior knowledge allows for deep processing of information. For example, when encountering novel information—meaning the learner does not have a rich storehouse of knowledge to apply to the new information—

surface processing is much more frequent as the learner seeks to understand (Alexander, 2003). The various SKL levels noted in prior research content (Schuh, 2004; Schuh et al., 2005) points to how learners initially engage with new information, which in turn points to their current depth about potentially related content, which further may indicate their baseline for potentially deeper understanding.

Late-elementary students seemed a viable group to study this linking process, particularly given the transition that takes places for this group of learners as described by developmentalists such as Piaget (e.g., Ginsburg & Opper, 1969). Links may become more abstract—metaphors or analogies, for instance—rather than stemming from concrete elements. Earlier research (Schuh, 2007) indicated differences in the kinds of links that lower-elementary and late-elementary students made. As learners begin to develop abstract reasoning skills and greater metacognitive skills such as self-regulation, they may also become better able to develop deeper links. Given the propensity of links for this age learner, as well as their differing value, it seems important that students learn to regulate their links.

Self-regulated learners direct their processing, motivations, and behaviors towards learning outcomes (Pintrich, 1999; Pintrich & Zusho, 2002; Zimmerman & Martinez-Pons, 1990). They use a number of strategies to plan, monitor, and regulate their activities and behavior. A well-regulated student can make adjustments to their efforts to foster alignment with tasks and the related goals that might accompany those tasks (Pintrich, 1999). SKLs point to one element of the regulatory process—evaluating personal links prompted by the content a student is studying. A well-regulated learner may choose to follow links that might be useful by thinking about the relationship, asking questions, or offering a comment in an elaborative way. Elaboration strategies provide opportunity for deeper processing of information (Pintrich, 1999). Further, teachers may support these kinds of promising links through classroom interactions (Schuh, 2003). A well-regulated learner may ignore those links that seem irrelevant. In contrast, learners with poor regulation skills may choose to follow irrelevant links and abandon the content being learned or may never elaborate potentially useful links. Therefore, it was our intent to develop an instrument to assess students' perceptions of how they linked new content with what they already knew, as well as their perception of their own regulation of those links.

Review of Existing Instruments

To begin the design process, we reviewed existing instruments prior to the development of the SKLIP. Our objective was to examine the surveys that dealt with content relevant to knowledge linking. These included the Learning and Study Strategies Inventory (LASSI; Weinstein, 1987), the Learning Style Profile (Keefe, Monk, Letteri, Languis, & Dunn, 1986), the Learning Style Inventory—Version 3 (Kolb, 1999), and the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, & McKeachie, 1991). The surveys were evaluated on the basis of content, item format, manual design, intended audience, answer sheet design, and instructions. As we noted these characteristics, our primary focus was on item content, as we first considered the names of the subscales to guide our search. For example, the MSQL included a subscale entitled "elaboration" that seemed to be similar to the construct of student knowledge linking. Each question in a subscale was then reviewed to determine whether the prompt included some description of a student linking something being learned with something already known. Given

this requirement, the questions needed three elements: two that indicated two different sources of information (e.g., prior learning versus something being learned now) and one that reflected the student being asked if they had made a connection of some sort (e.g., noting a relationship or link).

The LASSI (Weinstein, 1987) was designed to measure the degree to which high school and college-aged students employed successful learning strategies. The information-processing subscale was particularly relevant because it assessed the degree to which students created elaborations to facilitate learning. For example, one item stated, "I try to find relationships between what I am learning and what I already know," and the students responded by marking one of five options indicating the degree to which the statement was typical. The SKLIP items eventually took this form, including two items that were quite similar to two LASSI information-processing subscale items.

We also evaluated the Learning Style Profile and the Learning Style Inventory. The Learning Style Profile, designed for students in grades 6 through 12, indicated that a five-point Likert-response format could be appropriate for late-elementary students (Keefe et al., 1986). The Learning Style Inventory assessed the participants' learning tendencies and preferences (Kolb, 1999). Unfortunately, the Learning Style Profile and the Learning Style Inventory did not focus on how or to what students linked new information.

The MSLQ (Pintrich et al., 1991) assesses college students' motivation and learning strategies. The elaboration and self-regulation scales in MSLQ were particularly relevant to our study. The authors indicated that the activities included in the self-regulation scale helped students link new information to prior knowledge. Interestingly, the self-regulation section did not ask specifically about this linking. We did, however, choose to use three subscales (i.e., Rehearsal, Critical Thinking, and Elaboration) from the MSLQ (as reviewed by Duncan & McKeachie, 2005) to explore the validity of the SKLIP in its first implementation. We titled these three subscales collectively as the Learning Strategy Scales (LSS).

Generally, the instruments reviewed were developed for older students than those in our study. Late-elementary students begin the transitional state from concrete to abstract thinking that characterizes middle school students (Powell, 2011). An instrument designed specifically for this age seemed appropriate, as they may begin to develop strategies that move towards abstract linking, as well as greater personal regulation of learning processes.

Also of interest was the regulation of potential content-enhancing thoughts. However, existing questions in self-regulation instruments seemed to miss this mark, many focusing on goal setting (Wolters, 2004), regulation of learning/study strategies, as in Bandura's subscale on self-regulated learning within the Multi-dimensional Scales of Perceived Self-Efficacy (Choi, Fuqua, & Griffin, 2001), and monitoring understanding/completion of learning tasks (Schraw & Dennison, 1994) by using metacognitive strategies.

Methods

Instrument

After reviewing numerous instruments focused on learning styles, preferences, tendencies and behaviors, we realized that we would have to create an instrument that dealt specifically with how and to what late-elementary students were linking new information. The question format of the SKLIP followed that of the LASSI, the Learning Style Profile, and the Learning Style Inventory, using a 5-point Likert response format with students marking the degree to which they agreed a statement was true. Approximately 40 statements about student linking behaviors were drafted. These statements were designed to match the cues and trajectory dimension types that were noted in prior research (Schuh, 2003, 2007). The initial items were drafted to represent four constructs according to the specific linking behavior being assessed. These included *general* strategies (broad linking strategies such as generally seeking relationships, but not indicating specific kinds of strategies), *specific* linking strategies (e.g., linking to specific types of experiences such as something seen on television), and whether the links connected *in-school* or *out-of-school* contexts with what was being learned. We piloted 23 of the 40 items, choosing those questions that were clearest, best aligned with the categories, and most likely to capture the types of links that had occurred in the earlier qualitative studies. The remaining 17 items were discarded.

Participants and Pilot Studies

Two pilot studies took place in several combined 5^{th}-6^{th} grade classrooms in a Midwestern city. The participating schools were relatively similar in the percentages of minority students and those eligible for free and reduced lunch. The two groups of participating children were also similar in that there were an equal number of boys and girls in each of the pilot studies, with a majority of students being non-Hispanic White and in the 6^{th} grade (see Table 1). For each pilot study, the students completed the SKLIP in conjunction with a slate of other instruments that included the three subscales of the MSLQ Learning Strategy Scales (Duncan & McKeachie, 2005), called the LSS in this study. The pilot studies, as well as the field study that followed, were conducted with the approval of the local Institutional Review Board.

Table 1

Demographic Information of SKLIP Pilot 1, Pilot 2 and the Field Study

Demographic information	Pilot 1	Pilot 2	Field Study
Number of students	27[c]	92	469[d]
Number of schools	1	2	10
Number of classes	5	4	26
Grade			
5th	33.3	47.8	78.5
6th	66.7	52.2	21.5
Sex			
Boy	50	50	51.5
Girl	50	50	48.5
Race			
NHW[a]	72	68.5	84.5
Other[b]	28	31.5	15.5

Note. The percentage is presented in grade, sex, and race variables.
[a] Non-Hispanic White. [b] Includes American Indian, Hawaiian or Other Pacific Islander, Asian or Asian American, Black or African American, and Hispanic or Latino. [c] The effective N = 25 for presenting demographic information, given existing missing data. [d] The effective N = 466 for presenting demographic information, given existing missing data.

The first pilot study included 27 students. Despite the small data pool, the internal reliability of the SKLIP was quite strong ($\alpha = .92$). The correlations were strong between the SKLIP and the LSS, with the LSS explaining 73% of the variance in the SKLIP. We were not surprised by the relationship between the SKLIP and the critical thinking and elaboration subscales of the LSS ($r = .76$ and $r = .85$, respectively), given that these types of skills seem central in students' knowledge linking ability. However, the moderate relationship with the rehearsal subscale ($r = .62$) prompted us to think about how rehearsal may be a part of student spontaneous knowledge-linking for this small group of students. We chose not to administer the LSS in our second pilot study and the field study, given the time commitment of students completing a number of other instruments for the study and the established relationship of the LSS to the SKLIP given Pilot 1.

We examined the item-total statistics of this initial version of the SKLIP and again reviewed all items in light of the construct being measured. Fifteen of the 23 total items were strongly related, captured components of the construct, and were retained, some with small wording changes. Five of the items slated for removal had been classified as depth-of-linking items; these were combined into two multiple-choice response questions[1]. We also added an additional regulation question. Therefore, the revised SKLIP used in the second pilot study included 16 Likert-response items and two multiple-choice items.

The second pilot study included 92 students. The internal reliability of the instrument was again strong ($\alpha = .87$). Following this implementation we made a few modest changes to the instrument. Given the complexity of the sentences, we also improved the instructions through consultation with a 5^{th}-6^{th} grade teacher; for example, reminding students that if the sentence had two parts, they should consider the entire sentence. We also added a third multiple-choice question to further capture the students' regulatory efforts (Appendix A).

In the data analysis for both Pilot 1 and Pilot 2 we drew on Carifio and Perla's (2008) description for analysis of a Likert response format in questions, in that the Likert response format scale "produces empirically interval data" (p. 1150). Further, even when response types may be ordinal, this type of response "can and usually [do] produce scales that are empirically interval level scales" (Carifio & Perla, 2007, p. 110). Given this, our analysis for the pilot studies and the field study that followed used parametric analyses appropriate for interval data.

The Field Study

Participants in the field study included 476 late-elementary school students (males = 51.5%; grade 5 = 78.5%) and their teachers in 26 classrooms, in ten school buildings, in seven school districts. These seven school districts were generally rural, with three located in communities of less than 3,000 people, three in communities of less than 11,000 people, and one in a community of approximately 26,000. Of the nine school buildings providing school/community demographic information, the student minority population ranged from 4% to 20% and the percentage of students eligible for free/reduced school lunch ranged from 33% to 86% (M = 53.8%). Of the 476 students in the study, 469 participants completed the SKLIP (see Table 1).

Missing Data Treatment

Generally, the students were diligent about completing all of the items in the instrument, as had been the case in the two pilot studies. One student completing the SKLIP in the field study left six items blank and was excluded from the data analysis, as were the six students who did not complete any of the SKLIP items. For the remaining 469 students, 25 students left one item blank, and one student left two items blank. For these 26 students, we used the item mean

[1] We do not elaborate these questions in this paper as they relate more directly to the analysis of the Student Knowledge Linking Instrument, which captures students' actual linking given a brief text passage; see Schuh, Kuo, & Knupp, 2013. They are included in the SKLIP because of the question format.

substitution method as it is a viable solution for missing data when both the number of students with missing data and the number of items missing are less than 20% (Downey & King, 1996).

Determining the Subscales

Given the larger data pool of our field study, we first conducted item analyses to examine if any problematic questions remained. We were particularly concerned about a reverse scored item (question 4). A correlation matrix indicated that this item was not related to items in a predetermined construct (this had not been the case in the pilot studies, perhaps because of the smaller sample sizes). Given that past studies had shown that younger students may have difficulties responding to negatively worded items (Benson & Hocevar, 1985; Marsh, 1984), we chose to remove the item from the subscale analysis.

Exploratory and confirmatory factor analyses were conducted to cross-validate the theoretical constructs represented by the questions using two split datasets (Camstra & Boomsma, 1992; Cudeck & Browne, 1983; Mosier, 1951). We randomly selected 160 participants' data for an exploratory factor analysis (EFA) on the 15 items (item: subject ≈ 1 : 11). After examining these 15 items, the assumption of multivariate normality was likely violated, as indicated by a Shapiro-Wilk test. This violation, however, is not uncommon in studies of psychosocial assessment or social science. Past studies have indicated that a sufficient sample size could minimize the effects caused by the violation of multivariate normality while applying a maximum likelihood (ML) procedure (i.e., fairly robust to nonnormality) (Iacobucci, 2010; Jackson, Gillaspy, & Purc-Stephenson, 2009). Therefore, given this study's large sample size, the ML procedure was applied in the EFA and in the confirmatory factor analysis (CFA). Using maximum likelihood extraction and adopting a promax method for the oblique rotation, as we expected correlations among our factors, the EFA results showed that a total of 48.2 % variance was explained by SKLIP items imposing three potential factors. The factor pattern matrix is presented in Table 2.

Table 2

Pattern Matrix of SKLIP following the EFA

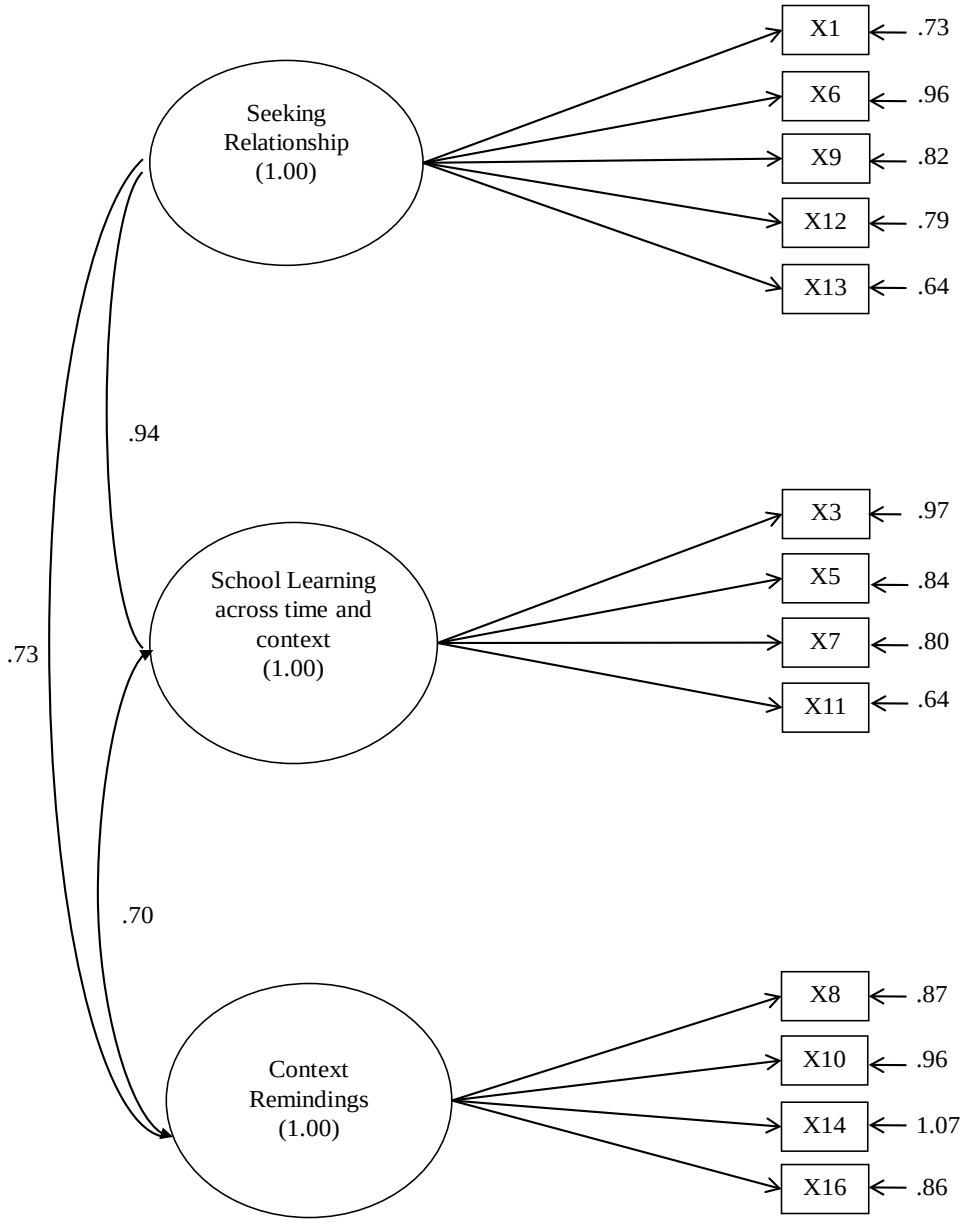
No.	Item	*M*	*SD*	Factors		
				F1	*F2*	*F3*
13	I find relationships between what I am learning and what I already know.	3.41	.91	**.91**	-.16	-.07
1	When we start a new topic in class I think about all of the things that I already know about it.	3.53	.88	**.76**	.00	-.12
15	I relate what I am studying to my experiences away from school. (question removed for CFA)	2.93	1.10	**.69**	.08	.10
12	When I'm learning something new, if a different idea comes to my mind I explore it to see if it would be helpful in understanding what I'm learning.	3.03	1.08	**.51**	.15	.03
6	When I learn about something that happened a long time ago, I compare the way things used to be with how they are now.	3.21	1.14	**.48**	.06	.18
9	When I am learning something new I come up with some useful ideas to help me understand the new information.	3.40	1.11	**.42**	.30	.09
5	When I learn something new, I think about how it is different from other things I already know.	2.86	1.02	-.08	**.89**	-.13
7	When I learn something new in class, I am reminded about other things I have learned in the same class.	3.14	1.12	.27	**.67**	-.27
11	When I learn something new in a class, it reminds me about other things I have learned in other classes this year.	3.01	1.03	-.11	**.65**	.21
3	When I learn something new in school, I am reminded of other things that I learned last year in school.	3.29	1.09	.01	**.54**	.21
2	When I learn about a country or place, I think of what it might be like to live there. (question removed for CFA)	3.47	1.17	.21	**.24**	.03
10	When I learn about things in school, they remind me of places I've been.	3.07	1.05	-.06	**.12**	.73
16	When I learn about important people in school, they remind me of people I know.	3.04	1.08	-.01	**-.19**	.65
8	I relate my experiences from out of school to what I'm learning in school.	2.92	1.14	.35	**-.13**	.59
14	When I learn about things in school, they remind me of movies or TV shows I have seen.	3.01	1.11	-.10	**.18**	.59

Note. n = 160. Item 2 and item 15 were not included in the final SKLIP scale due to conceptual and psychometrical concerns. Multiple-choice items 17-19 were included in the final SKLIP scale (see Appendix A). F1 was named Seeking Relationship; F2 was named School Learning across Time and Context; and F3 was named Context Remindings.

The items in the proposed three factors were reviewed for conceptual consistency. Items that were highly correlated but from different factors were removed, as were those with factor loadings less than .3 (Costello & Osborne, 2005; Hogarty, Hines, Kromrey, Ferron, & Mumford, 2005). Thirteen items remained for a CFA.

Using the other split dataset, i.e., the remaining 309 out of the original dataset of 469 students (the indicator to subject ratio being approximately 1: 24), factors were estimated using maximum likelihood after first imposing unit loading identification constraint. Fit indices such as the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR) were examined (Hu & Bentler, 1999). This hypothesized CFA model fit reasonably well (χ^2 = 110.656, *df* = 62, $p < .001$, CFI = .923, RMSEA = .050 [.035 - .065], SRMR = .051) (see Figure 1).

Figure 1. The SKLIP CFA model



Note. The unstandardized coefficients are reported.

According to the EFA and CFA results, the three SKLIP subscales were constructed and named as Seeking Relationships (items 1, 6, 9, 12, and 13), School Learning Across Time and Context (items 3, 5, 7, and 11), and Contextual Remindings (items 8, 10, 14, and 16). Seeking Relationships captures students' intentionality in making general relationships between what they are learning and what they already know. School Learning Across Time and Content captures students' relating new learning to prior school learning. The third subscale, Contextual Remindings, captures specific comparisons that students made with information that was typically gained out of school.

Reliability

The overall internal reliability of the SKLIP (N = 469) was .80. The internal reliabilities of three subscales were between .59 and .68. Given that the nature of this study was to explore students' knowledge-linking perceptions, the internal reliabilities in this study are adequate (Hair, Black, Babin, Anderson, & Tatham, 2006). Correlations among the subscale mean scores were moderate between .41 and .59 (see Table 3).

Table 3

Descriptive Statistics and Correlations among SKLIP Subscales

	M	*SD*	1	2	3
1. Seeking Relationships	3.22	.69	.68		
2. School Learning Across Time and Content	3.01	.74	.59***	.64	
3. Contextual Remindings	2.95	.74	.46***	.41***	.59

Note. N = 469. Internal reliabilities are presented on the diagonal.
*** $p < .001$

Students completed two subscales of Social Constructivism and Active Learning Environments (SCALE; Bonk, Oyer, & Medury, 1995): the Generate Connections and the Student Prior Knowledge/Meaningfulness subscales. These were administered as a component of our larger study where we considered the role of the learning environment in student-linking efforts. Our expectation was that student responses to these two subscales would be similar to those of the SKLIP, given that they individually addressed the issues of connecting information and using prior learning (which we had combined in the SKLIP). When administered to 453 sixth to twelfth graders, reliability was .52 for Generate Connections and .60 for Student Prior Knowledge/Meaningfulness (Bonk et al., 1995). We excluded the two negatively worded items from each of the SCALE subscales, given the age of learners in our study (Marsh, 1984). The SKLIP Seeking Relationships had the strongest relationship to the two SCALE subscales. Although all of the correlations were significant, our analysis indicated that Contextual Relations, which to our knowledge is unique in asking about these out-of-school links, shows the least similarity with the two SCALE subscales (see Table 4).

Table 4
Correlations among SKLIP Subscales and SCALE (Bonk, et al., 1995) Subscales

	SCALE Generate Connections	SCALE Student Prior Knowledge
Seeking Relationships	.40***	.47***
School Learning Across Time and Content	.40***	.39***
Contextual Remindings	.31***	.22***

Note. N = 449.
*** $p < .001$

Content Regulation

Given our interest in student regulation of their knowledge linking, we carefully considered the relationship between student responses to questions in the Contextual Remindings subscale and Q19, a multiple-choice item asking about the student's behavior when something new comes to mind while learning about something else. The Contextual Remindings subscale seemed particularly appropriate for this post hoc analysis because the items pointed to specific out-of-school experiences that might be relevant in school learning. We were concerned whether this type of linking might be distracting, prompting students to not pay attention.

In Q19 (see Appendix A) students were asked to indicate what they did, through their choice of four options, if something else came to mind when learning in school. We were essentially seeking to identify the effect of the linking process. Table 5 presents descriptive statistics for responses to the Contextual Remindings questions (i.e., questions 8, 10, 14, and 16) based on the four options chosen by students. Given students' responses in Q19, one-way analysis of variance (ANOVA) was conducted to investigate if students perform differently on these individual questions.

Table 5

Descriptive Statistics of Questions in the Contextual Remindings Subscale Given the Options Students Chose in Question 19

	Option1 (n = 101)		Option 2 (n = 185)		Option 3 (n = 134)		Option 4 (n = 45)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Q8	2.96	1.15	3.07	1.09	2.78	1.17	2.91	1.10
Q10	2.97	1.16	3.14	1.07	2.80	.99	2.53	1.01
Q14	2.74	1.11	3.00	1.11	3.13	1.12	2.64	1.17
Q16	2.99	1.04	3.13	1.04	2.79	1.14	2.64	1.19

Note. N = 465

Students who chose the different options to question 19 (see Table 6) differed in their responses to question 10 regarding being reminded of places ($F(3, 461) = 5.09$, $p = .002$), question 14 about being reminded of movies or TV shows ($F(3, 461) = 3.63$, $p = .013$), and question 16 regarding people the student knew ($F(3, 461) = 3.87$, $p = .009$ (see Table 2 for questions). Given the significant mean differences in questions 10, 14, and 16, Tukey's post-hoc tests were used to detect mean differences among students choosing different options in question 19. The results indicated that students who tried to figure out if the link was helpful were more likely to have school information remind them of places they have been (Q10) or people they knew (Q16) than students who indicated that they would stop paying attention to the information presented in school. In contrast, students who were more likely to indicate that they would stop paying attention to the school content were more likely to be reminded of TV shows or movies (Q14).

Table 6

Analysis of Variance for Four Questions in the Contextual Remindings Subscale by Students' Choice of Four Options in Question 19

Question	Source	*SS*	*df*	*MS*	*F*	Mean Difference
Q8	Option	6.47	3	2.16	1.69	
	Error	588.28	461	1.28		
	Total	594.75	464			
Q10	Option	17.25	3	5.75	5.09**	Option 2 > Option 3*
	Error	521.29	461	1.13		Option 2 > Option 4**
	Total	538.55	464			
Q14	Option	13.64	3	4.55	3.63*	Option 3 > Option 1*
	Error	578.21	461	1.25		
	Total	591.85	464			
Q16	Option	13.72	3	4.57	3.88**	Option 2 > Option 3*
	Error	544.34	461	1.18		Option 2 > Option 4*
	Total	558.05	464			

Note. N = 465. SS = Sum of Squares; df = degree of freedom; MS = Mean Square. Tukey's HSD post-hoc test was used to detect the mean differences between chosen options.
* $p < .05$. ** $p < .01$.

Discussion

Instruments exploring how late-elementary students think, construct their understandings, and monitor their processes are either limited or have often been adaptations from instruments for older students. The SKLIP, a new learning inventory which measures late-elementary students' perceptions of their creation of SKLs, was developed to address this need. Development of the SKLIP for late-elementary students provided substantive evidence of construct validity (Clark & Watson, 1995). In our development of the SKLIP, we sought to write statements in the language of late-elementary students, subjecting the instrument to multiple pilot studies. Further, the item content was developed in a grounded way, drawing on data that included types of links that late-

elementary learners make. Descriptive statistics and cross-validation through the EFA and CFA using the split datasets provide psychometric evidence to enhance the validity of the scale constructs.

The SKLIP poses questions to students about active processes in which they may engage that allow them to link what they are learning with what they already know. The correlations among the three subscales were not surprising, given that students who have generative learning strategies may have a variety of these strategies. Some of these strategies may be more appropriate for particular content, whereas others may be more appropriate given the particular prior experiences of the learner. While the reliabilities of the Seeking Relationships and School Learning Across Time and Content subscales seem adequate, the lower reliability of the Contextual Remindings subscale may be of concern. While the lower reliability of this subscale may be due to the smaller number of items (Anastasi & Urbina, 1997; Cortina, 1993) the explanation could also be conceptual based upon individual variation. Yet, given the nature of the subscale—that students respond to a variety of types of links they may make (considering people, places, or media links, for example)—it would seem unlikely that one student may use all of these strategies given their own prior experiences.

The questions in the Seeking Relationships subscale are most similar to questions in the SCALE Generate Connections subscale (Bonk et al., 1995) and the LASSI (Weinstein, 1987), given their general nature. Certainly, the SKLIP would benefit from further validation efforts to determine the similarity. What is unique about the SKLIP are the questions that ask about links students make with other school content and with experiences typically gained out of school. School Learning Across Time and Context captures the links that teachers hope students make as they move from year to year in school and also points to the links that may be made through interdisciplinary projects that have become common in schools (Powell & Allen, 2001). Although the SKLIP asked students about their own use of these linking strategies, teachers can become adept at prompting these types of links by modeling links, prompting links with questions, and providing experiences in school that allow linking across content and activities within content areas (Schuh, 2003).

The Contextual Remindings subscale is unique in asking students how they link out-of-school learning with what they learn in school. This subscale, in particular, may be better considered a brief inventory, where students note the types of specific links they typically make given what seems salient in their prior knowledge. As students develop generative learning strategies, the items in the SKLIP may be used by practitioners to identify strategies that may be added to students' repertoire of linking strategies. The SKLIP may provide practitioners a look at how students are linking what they have learned in other venues and across grades, across subjects, and within subjects. If students have limited generative strategies, items in the SKLIP point to strategies that could be added to the students' strategy repertoire. Fostering these linkages seems particularly important given the integrated-curriculum focus that is incorporated into school curricula for this age student (Powell, 2011) .

Given the pervasiveness of media exposure of school-age students, with 8 to 10 year olds watching on average three hours and 41 minutes of television per day and 11 to 14 year olds watching just over five hours per day (Rideout, Foehr, & Roberts, 2010), it is not surprising, but

it *is* problematic, that students who note linking to TV and movies also note forgetting to pay attention in class. While children's media exposure is not a new phenomenon, examining how the results of excessive viewing limit generative learning is of interest. Further, gathering relevant demographic information about students' attention challenges, such as Attention Deficit Hyperactivity Disorder diagnoses, would be useful in unpacking why the TV/movie links may be related to students' lapses in attention when learning something new, while linking to places or people is not. Further, Pintrich and Zusho (2002) note a developmental aspect to self-regulation that hinges on prior learning. Yet prior learning from particular contexts may vary in usefulness as elements of a generative learning process, particularly for learners this age, who may be lacking self-regulation strategies.

Given constructivist definitions of learning in which students are said to link what they are learning with what they already know (e.g., Bransford et al., 1999; Bruning et al., 2004; Derry, 1992; Jonassen, 1999; von Glasersfeld, 1995), developing an instrument to focus on this construct will further our understanding of student learning processes, including how they regulate their personal links with new information. Learners have a variety of experiences that function as prior learning. Asking students to consider how they link what they bring from outside of the classroom to their new learning begins to identify age-appropriate, student-identified strategies that can foster students' elaboration of content.

Limitations and Future Research

As with the development of any new instrument, there are a number of limitations to note. First, the students within and across the different studies experienced the study's administration in different ways. For example, the SKLIP was administered by a substitute teacher in one school in Pilot 2. Students completed a slate of instruments that included the SKLIP. Because of varying classroom schedules, some classrooms completed the instruments in different orders, and some used more than one day to complete the instruments. Despite these administration limitations, we believe the SKLIP supports a better understanding of this little-studied construct that seems so tightly embedded into many descriptions of learning.

As use of the SKLIP continues, a number of particular items that conceptually seem better grouped with other items should be further scrutinized. For example, question 6 seems to fit with the more specific strategies of the Contextual Remindings subscale, while question 5 seems better aligned with general strategies in the Seeking Relationships subscale. While we continue to support the removal of question 4 because of low inter-item correlations, questions 2 and 15, which were removed following the EFA, may be worth further review given administration to other populations. Their inter-item correlations fit well with the rest of the instrument and they are conceptually relevant items.

Next steps for the SKLIP should also include further study of the regulation component, its relationship to achievement outcomes, and the types of learning environments that foster useful regulation. While the SKLIP considers students' perceptions of this linking ability, the Student Knowledge Linking Instrument (SKLI; Schuh et al., 2013), concurrently developed and administered, captures students' link levels. This pair of instruments should provide a valuable sense of how students are building new understandings through linking what they are learning

with what they already know. Understanding how student knowledge linking, classroom environment, and ultimately academic achievement are linked is the continuing focus of this strand of research.

The SKLIP has been developed for late-elementary students, drawing on prior research about links that students made between the content they were learning and what they already knew. It captures students' perceptions of the type of links that they make. With a reliability of 0.80, the SKLIP contains three subscales: Seeking Relationships, School Learning Across Time and Context, and Contextual Remindings. The relationship about remindings from media sources and the resulting distraction prompts consideration about how to support students' media experiences as viable prior learning in the classroom. The SKLIP provides a useful tool for considering this and other relationships that students may make between what they are learning and what they already know.

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Appendix A

SKLIP Questions 17-19

17. When I learn something new in school, I think of other things that
- O have the same behavior or act the same way.
- O look the same.
- O use the same process.
- O I don't do any of these.

18. When I think about how two things are similar or different, I compare
- O how they look, but not their behaviors.
- O how they act, but not how they look.
- O how they look and how they act.
- O I don't do any of these.

19. When I am learning something new, if something else comes to mind, I
- O ignore what has come to mind **and** keep paying attention to the new things I'm learning.
- O try to figure out if what has come to mind will be helpful in learning about the new things.
- O start thinking about what came to mind **and** stop paying attention to the new things I'm supposed to be learning.
- O I don't do any of these.