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Exploring Multidimensional Approaches to Learning During Early Childhood in Ghana

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Abstract

Children's approaches to learning (AtL) are widely recognized as a critical predictor of educational outcomes, especially in early childhood. Nevertheless, there remains a dearth of understanding regarding the dimensionality of AtL, the reciprocal dynamics between AtL and learning outcomes, and how AtL operates in non-Western contexts. This paper aims to extend the existing AtL literature by both conceptually and empirically investigating the dimensionality of the AtL scale of the International Development and Early Learning Assessment (IDELA) – a globally used measure of early childhood development – based on data from Ghanaian children newly enrolled in formal schooling. Additionally, our research explores reciprocal relationships between AtL subconstructs and academic skills over time. Our analysis identifies two dimensions within the IDELA AtL scale: Self-Regulation (SR) and Motivation. We found that children with higher levels of SR early in schooling demonstrated better literacy and numeracy skills in later grades compared to their peers with low early SR, whereas children's motivation did not predict subsequent literacy and numeracy skills. This study enhances understanding of AtL in non-Western contexts, with implications for culturally appropriate support for children's engagement in learning.

Keywords: early child development, approaches to learning, low- and middle-income countries, factor analysis, cross-lagged panel analysis

Exploring Multidimensional Approaches to Learning During Early Childhood in Ghana

Scholars have posited the concept of children's approaches to learning (AtL) as a crucial learning goal in the education system, especially during early childhood (Kagan et al., 1995; Scott-Little et al., 2006). AtL is a multidimensional construct involving motivation, curiosity, creativity, and self-regulation, representing the different ways in which children engage in learning (Claessens et al., 2009; Kagan et al., 1995). The significance of AtL is reflected in policy documents in the US and globally. For instance, Head Start, the federally funded early childhood education policy in the US, places AtL as one of five developmental domains that all children are expected to develop during early childhood (US Department of Health and Human Services, 2015). Similarly, early learning and development standards (ELDS), internationally promoted by UNICEF, include AtL as one of five key early childhood developmental domains (UNICEF, 2017). The importance of AtL is supported by empirical evidence that has demonstrated that AtL predicts children's academic learning outcomes. For instance, scores on a teacher-reported AtL scale at kindergarten entry were significantly correlated with US students' subsequent academic achievement (Claessens et al., 2009; Lee, 2012; McDermott et al., 2002; Musu-Gillette et al., 2015; Sung & Wickrama, 2018).

At the same time, less is known about the dimensionality of AtL, bidirectional relations between AtL and learning outcomes, and how AtL operates outside of Western contexts. This paper aims to address these gaps in the literature by exploring the dimensionality of the AtL scale of the International Development and Early Learning Assessment (IDELA; Pisani et al., 2018), a commonly used measure of early childhood development in global settings, based on data from Ghana. Additionally, we seek to examine the reciprocal relationships between the subconstructs of AtL and academic skills over time.

Dimensionality of AtL

Kagan et al. (1995) conceptualize AtL as an umbrella term that includes different sets of skills that support children's ability to learn in classroom settings. In line with this conceptualization, AtL is often treated as a "catch-all" category, with different studies including different subconstructs within AtL (Beisly, 2023). Indeed, researchers interested in measuring AtL will often average indicators of various related skills together to form a composite score. For example, the nationally-representative, US-based Early Childhood Longitudinal Study-Kindergarten (ECLS-K) dataset employs a singular teacher-reported measure of AtL that incorporates multiple subconstructs of AtL (e.g., attentiveness, persistence, flexibility, eagerness to learn; Bodovski & Farkas, 2007; Claessens et al., 2009; Li-Grining et al., 2010; Musu-Gillette et al., 2015; Sung & Wickrama, 2018). Similarly, the East Asia-Pacific Early Child Development Scales (EAP-ECDS), a direct child development measure used in East Asian and Pacific countries, includes a unidimensional AtL scale consisting of indicators that tap into inhibition control, persistence, curiosity, and independence (Li et al., 2019; Sun et al., 2018).

Operationalizing AtL as a unidimensional construct raises substantive concerns. In particular, it is possible that different dimensions of AtL contribute differently to children's learning and that these variations depend on individual and contextual factors. Combining multiple components into one composite score makes it impossible to investigate the different roles that each aspect of AtL may play. Furthermore, unidimensional measures of AtL often suffer from psychometric issues, with studies showing these measures lack evidence for factorial validity (McDermott et al., 2014) and ignore the possibility that the indicators have different development processes (Wu, 2022).

In this study, we begin to push back on the unidimensionality of AtL measures by proposing – and measuring – two primary dimensions of AtL: self-regulation and motivation. This multidimensional conceptualization of AtL is supported by both empirical evidence and theory. In particular, several studies have demonstrated the multidimensional nature of AtL through analyses showing latent dimensions of Competence Motivation and Attentional Persistence (McDermott et al., 2002), each of which has been shown to differentially relate to children's learning outcomes (McDermott et al., 2014). The distinction between self-regulatory and motivational dimensions of AtL is also consistent with the differentiation between ability and inclinations proposed by several theoretical frameworks. In particular, multiple theories, including self-determination theory (SDT; Zimmerman, 1990; Zimmerman & Moylan, 2009) and dispositional theory (Perkins et al., 1993, 2000), have highlighted the importance of *self-regulation* as a set of abilities (e.g., planning, focusing, managing impulses) that supports children's engagement in the learning process. These theories also argue the additive or complementary importance of *motivation* as an inclination that helps children to engage in the learning process. For example, dispositional theory maintains that even with self-regulation ability, a child may not instantiate self-regulated learning unless this regulatory ability is accompanied by motivation (Perkins et al., 1993). SDT further highlights the particular importance of intrinsic motivation, involving a high level of autonomy and associated with activities exercised for their inherent satisfactions, as opposed to extrinsic motivation, associated with behaviors performed to satisfy an external demand or reward (Ryan & Deci, 2000).

Possibility for bidirectional relations between AtL and learning outcomes

As noted above, numerous studies have identified associations between AtL and children's later learning outcomes. For instance, several studies using the ECLS-K have

established positive associations between children's AtL scale scores in kindergarten and their academic achievement in later grades, using both single time points (Claessens et al., 2009; Lee, 2012) and trajectories (Li-Grining et al., 2010; Sung & Wickrama, 2018). Such associations also make sense from a theoretical standpoint, as a core premise of AtL is that it reflects the competencies necessary for children to engage in effective learning and acquisition of new knowledge (Claessens et al., 2009; Kagan et al., 1995).

At the same time, less work has considered the ways in which AtL and learning outcomes may be related to one another reciprocally over time. Although a small handful of studies have shown that higher early academic achievement is associated with enhanced levels of AtL in subsequent years (e.g., Bodovski & Farkas, 2007; Musu-Gillette et al., 2015), no studies, to our knowledge, have explicitly tested how AtL and academic skills codevelop over time. Several theories support the notion of bidirectionality between AtL and learning outcomes. For example, SDT suggests that enhanced perceived competence as a result of better performance may foster intrinsic learning motivation, in turn shaping better learning outcomes over time (Ryan & Deci, 2000). Empirical studies with high school and college students in Canada and Sweden support this hypothesis (Taylor et al., 2014). Similarly, self-regulated learning theory maintains that motivational beliefs are both a cause and an effect of children's efforts to engage in learning proactively, where enhanced learning outcomes can lead to further positive motivational beliefs through positive self-satisfaction (Zimmerman & Moylan, 2009). Hence, while higher AtL can result in better learning outcomes, improved learning outcomes may further reinforce the motivational aspect of AtL. Therefore, it is crucial to examine the bi-directional relationships between AtL and academic outcomes to fully understand the role of AtL in learning trajectories.

AtL across Contexts

Much of the current empirical literature on AtL is focused on Western contexts, particularly the US. Although this literature has been useful in establishing a basic understanding of how AtL may operate in the West, scholars have also noted that subconstructs of AtL may operate differently within and between cultures (Kagan et al., 1995). Indeed, there is ample evidence that development and learning patterns in different domains may vary across contexts (McCoy, 2022). Henrich et al. (2010) also explain that people from Western, industrialized societies are at the extreme end of the distribution in various related domains, including self-perception, personal choice, and motivation to conform. Therefore, the current, Western-centric literature on AtL may provide a limited understanding of how AtL looks or operates in Majority World contexts.

In the present study, we focus specifically on understanding AtL in Ghana. Ghana is a lower-middle-income country where the education system prioritizes children's social responsibility and obedience, with highly teacher-directed instruction and classroom management practices throughout grade levels (Agbenyega, 2018; Akyeampong, 2017). This educational orientation stands in contrast to that of many Western high-income countries, which often place relatively more value on student curiosity and individual initiative (Chen & Wolf, 2021; Jukes et al., 2023; Serpell, 2011). Accordingly, in the Ghanaian educational context, self-regulation may be particularly relevant since students with good self-regulation skills may exhibit behaviors that can be taken as respectful and attentive by teachers (Chen & Wolf, 2021). On the other hand, some learning behaviors driven by intrinsic motivation and curiosity, such as actively asking questions, may not be well received by adults since they do not align with their socially oriented goals related to togetherness and cooperation (Jukes et al., 2023; Lancy, 2014). In addition to such social-cultural values, more structural factors, such as large class sizes and

limited learning resources, may contribute to the challenges in implementing "learner-centered" pedagogies in Ghana (Chen & Wolf, 2021). Also, the prevalent extrinsic reinforcement may bolster children's extrinsic motivation. Indeed, a previous study in Ghana by McCoy et al. (2014) found that students with more extrinsically oriented motivation attended school more regularly than their intrinsically motivated peers, potentially due to differences in how differently motivated learning styles are perceived in the Ghanaian educational context.

Current Study

This study aims to extend existing conceptualizations of AtL by examining the dimensionality of an AtL measure for Ghanaian kindergarten children and the reciprocal relations between AtL subconstructs and academic skills over two years. Data for this study come from the first three waves of an impact evaluation of the Quality Preschool for Ghana (QP4G) project (Wolf et al., 2019, 2019). We propose that investigating the relations between children's AtL and academic outcomes in the context of Ghana will help to expand the scope of the largely US-based literature and deepen understanding regarding the form and relevance of AtL across settings with vastly different approaches to education.

We begin with measurement analysis to explore and confirm the dimensionality of the AtL scale in the IDELA (Pisani et al., 2018). Specifically, through conceptual analysis, we classify IDELA AtL items into two categories: self-regulation skills and motivation. Then, using the baseline data collected in September 2015 (Time 1) when children were in Kindergarten 1 (KG1) and Kindergarten 2 (KG2), we test the following research question (RQ1): *Is the variance in the IDELA AtL scale items explained by underlying latent constructs of self-regulation skills and motivation, as per the theoretically suggested two-factor model?* Answering this question will help us understand whether the IDELA AtL scale measures two dimensions of AtL or one

overall dimension where the motivational and regulation aspects are indistinguishable. After investigating whether the subconstructs of the IDELA AtL scale manifest similarly across the late early childhood period, we next examine the possibility of bi-directional relations between AtL and learning outcomes. Specifically, we ask the following research question (RQ2): *How do academic skills and subconstructs of AtL associate with each other across the late early childhood period?* By addressing this question, we hope to gain a better understanding not only of how subconstructs of AtL relate to later academic skills, but also whether earlier academic skills predict the development of subconstructs of AtL.

Methods

Participants

We used the first three waves of the data collected from the QP4G project (Wolf, 2019; Wolf et al., 2019, 2019). This parent study aimed to examine the effects of teacher training and a parental awareness program in 240 schools in six districts within the Greater Accra Region of Ghana through a randomized control trial. The interventions were implemented during the 2015-2016 school year with two cohorts of children, and data were collected at three time points: September 2015 (Time 1), when the first cohort of children was in KG1 (the US equivalent of preschool) and the second cohort of children was in KG2 (the US equivalent of kindergarten), June 2016 (Time 2; at the end of children's first or second year of kindergarten), and June 2017 (Time 3; at the end of children's 2nd year of kindergarten or first year of primary school). The parent study was reviewed and approvaled by [blinded for review]. For the present study, we will make use of each of these time points to examine children's AtL over time, but will not leverage random assignment to the intervention itself.

The schools in the six districts were identified for the QP4G study using the Ghana Education Service Educational Management Information System database, which contained a full list of registered schools in the country. From this list, schools were randomly selected, with stratification by district and school type (public or private). In the case of public schools, all schools were included in the sample, as there were only 108 across the six districts. Out of the total 490 private schools, a proportional sample of 132 private schools was selected based on the number of private schools in each district relative to the overall total across all districts.

At Time 1, passive consent was taken from the caregivers of all but 10 KG1 and KG2 children in the selected schools. Among the consented children, 15 were randomly selected from each school's roster (8 from the KG1 cohort, with a mean age of 5.3 years, and 7 from the KG2 cohort, with a mean age of 6.3 years) to participate in the direct assessments. In some schools, a combined KG classroom was present instead of separate KG1 and KG2 classrooms. In such cases, 15 children were randomly selected from the combined class. In schools with fewer than 15 KG children, all available children were included in the sample. At Time 1, a total of 3,435 children were included in the sample.

In Ghana, it is common for children to relocate in order to live with extended family members during the school year for various reasons. Despite efforts made to maintain contact with each child in the sample, attrition occurred during the study. At Time 2, 432 children were added to the sample in two scenarios: (1) replacing children who had left the school with children from the existing classroom roster, and (2) adding children to schools that experienced an increase in enrollment from Time 1 to Time 2 and had fewer than 15 KG children at Time 1. At Time 3, significant effort was made to include all children from the Time 1 and Time 2 samples, even if they were not available in the previous wave.

In total, the full analytic sample included all 3,867 children with any available data across the three waves (i.e., 3,435 from Time 1 plus 432 added at Time 2). Among this full sample, the majority (68.7%; *n* = 2,657) had child developmental data at all three time points, while 20.3% (*n* = 787) had data at two of the three waves, and 10.9% (*n* = 423) had data at only one wave. Approximately half of the children in the sample were male (50.8%), and the average age at Time 1 was 5.80 years (SD = 1.32).

Measures

IDELA

Trained assessors directly assessed children's AtL and academic skills using the IDELA. The IDELA was designed to measure multiple developmental domains, including literacy, numeracy, social-emotional skills, motor skills, executive functions, and AtL, and is intended for use in low-resourced settings across the globe (Pisani et al., 2018). The development of IDELA was informed by various early childhood learning and development assessments used across countries. In the QP4G study, the IDELA protocol was carefully reviewed by local child development experts and piloted with 20 children from the Accra metropolitan area and the Greater Accra Region, aiming to ensure the cultural appropriateness of the assessment tool in the study context. Very few changes were made to the tool, primarily related to word choice and simplifying instructions. To ensure accurate translations, the IDELA tool was translated from English into three local languages (Twi/Fanti, Ewe, Ga) using forward and backward translation methods, followed by discussions with local experts to resolve any discrepancies and confirm accuracy. The assessors, who spoke the language used in the administration, were trained for 5

days, followed by 2 additional days of field practice facilitated by a master trainer, as designated by the IDELA developers (Pisani et al., 2018).

In the current study, we used IDELA data, focusing specifically on the AtL and two academic skills (emergent literacy and numeracy). While we modeled multidimensional latent AtL constructs in the measurement and full structural models, we used observed scores for literacy and numeracy skills, which are consistent with prior research (e.g., Wolf & McCoy, 2019).

Approaches to Learning

The AtL module of the IDELA consists of seven items based on the assessor report. After the assessor completed the rest of the IDELA assessment with each child, they filled out the items about the child's AtL based on their observations of child's behaviors, using a scale of 1–4, with 1 = "almost never" and 4 = "almost always." The items cover various aspects of AtL: items 1 (attention), 2 (confidence), 3 (concentration), 4 (carefulness/accuracy), 5 (pleasure), 6 (motivation/persistence), and 7 (curiosity). See Table 1 for the full description of the AtL items.

Academic Skills

Children's emergent literacy skills were assessed using 38 items nested in six subtasks, which encompassed various aspects of literacy development, including print awareness, letter knowledge, phonological awareness, oral comprehension, emergent writing, and expressive vocabulary. For instance, children were presented with a series of letters one at a time to assess letter knowledge. The assessor pointed to each letter and asked the child to identify it by saying, "What letter is this?" The task included a total of 20 letters, with the first 10 being high-frequency letters and the remaining 10 representing lower-frequency letters. Scores for each subtask were computed as the proportion of correct responses, ranging from 0 to 1, and then

averaged across all subtasks to obtain an overall emergent literacy score. The internal consistency for the emergent literacy scale was acceptable, with Cronbach's alpha coefficients ranging from .72 to .88 across the three time points.

The emergent numeracy subscale consisted of 39 items grouped into eight subtasks designed to measure various aspects of children's numeracy skills. These subtasks covered various numeracy skills, including evaluating number knowledge, basic addition and subtraction, one-to-one correspondence, shape identification, sorting based on color and shape, size and length differentiation, and completion of a simple puzzle. For instance, to assess children's one-to-one correspondence, they were given a pile of beans and asked by the assessor to hand over a specific number of beans, such as 3 or 8. Scores for each subtask were computed as the proportion of correct responses, ranging from 0 to 1, and then averaged across all subtasks to obtain an overall emergent numeracy score. The internal consistency for this subscale was acceptable, with Cronbach's alpha coefficients ranging from .70 to .72 across the time points.

Covariates

To account for possible confounders, we controlled for the respective baseline outcome variables and additional covariates in the analyses based on the variables controlled by Wolf and McCoy (2019). Child-level covariates include their age in months and sex. Household-level covariates included the number of books in the home and the Simple Poverty Scorecard for Ghana (Schreiner & Woller, 2010), a validated metric of household poverty levels for Ghana that ranges from 0 to 100, derived from a set of ten household variables (e.g., number of household members, highest grade completed by female head or spouse, source of drinking water). The child’s primary caregiver (41.6% mothers, 44.6% fathers, and 13.8% other) reported these child and household data at Time 1, and/or taken from school records. Lastly, four school-level

covariates were included: an indicator for whether the school was private (vs. public), an indicator for the grade level of the child (KG1, KG2, or a mixed KG1/KG2 classroom), a set of indicators for the school's district, and a set of indicators reflecting the school's treatment assignment in the broader QP4G study. These covariates are empirically found or theoretically expected to predict early skills. Therefore, controlling for them helps mitigate, if not eliminate, selection bias.

Analytic Approach

RQ1: *Factor Structure of the AtL Scale*

To address research question 1, which concerns the factor structure of the IDELA AtL scale items, we begin by categorizing each IDELA AtL item into conceptual domains based on the social-emotional learning (SEL) taxonomy framework (Jones et al., 2021; see Supplementary Table S1). Then, we grouped the items into two hypothesized dimensions of AtL: Self-Regulation (SR) Skills, related to the SEL taxonomy's "Skills and Competencies" (Cognitive Skills domain), and Motivation, related to the SEL taxonomy's "Belief Ecology" (Values, Perspectives, and Identity domains).

After conducting basic descriptive analyses of the AtL items at Time 1, we next conducted a factor analysis to determine whether underlying latent constructs of SR and Motivation explain the variance in responses to AtL items. Specifically, we randomly divided the baseline data into an exploratory and a confirmatory sample. Using the exploratory sample, we conducted exploratory factor analysis (EFA) based on a principal axis factor extraction technique with promax rotation. Although we had a theoretical model based on conceptual mapping, we started with EFA due to a lack of prior empirical evidence regarding the factor structure of the IDELA items, as well as some ambiguity in the content analysis.

We then used the confirmatory sample to run a confirmatory factor analysis (CFA) to test the generalizability of the model proposed by the conceptual mapping and EFA. We investigated goodness of fit based on the comparative fit index (CFI), root mean square error of approximation (RMSEA), its 90 percent confidence intervals, and a Standardized Root Mean Square Residual (SRMR). We use a cutoff value close to .95 or higher on the CFI and close to or below .08 on the RMSEA and SRMR as the criteria of good fit (Kline, 2016). We also compared the proposed two-factor model against a one-factor model to examine if the theoretically suggested multidimensional model was empirically supported.

To examine whether the subconstructs of the IDELA AtL scale were similar across time, we conducted measurement invariance analysis. We fit the same models from the CFA of the AtL items to the second and third waves of the data and investigated their fits to test configural invariance. We also examined if their loadings and intercepts were equivalent across the time points by imposing an equality constraint on unstandardized loadings and intercepts to test metric and scalar invariance, respectively. We used the marker variable method as our identification strategy (Kline, 2016). We examined the fit of sequentially constrained models based on above mentioned fit criteria, as well as comparing their relative fit against the preceding model (i.e., the metric invariance model against the configural invariance model). Since chi-square difference tests can be overly sensitive to small deviations in large samples (Putnick & Bornstein, 2016), we mainly used additional criteria recommended in the literature. Namely, we considered a .01 or larger change in CFI (Chen, 2007; Cheung & Rensvold, 2002) and .015 or larger changes in RMSEA in our criteria for measurement non-invariance (Chen, 2007).

The following proportions of the full analytic sample were dropped from the EFA, CFA, and measurement invariance analysis due to missing data on all indicators: 10.86% of the Time 1

EFA sample, 11.53% of the Time 1 CFA sample, 11.90% of the Time 2 sample, and 19.16% of the Time 3 sample. Smaller proportions of the full analytic sample had missing data on some but not all indicators: 0.36% of the Time 1 EFA sample, 0.47% of the Time 1 CFA sample, 0.36% of the Time 2 sample, and 0.18% of the Time 3 sample. To address these cases with missing data on some indicators, , we employed full information maximum likelihood (FIML) estimation with robust standard errors (Huber-White) and a scaled test statistic. While categorical estimation methods (e.g., weighted least squares) are recommended for analyzing categorical items, we opted to use robust maximum likelihood estimation (MLE) methods to address missing values, as the treatment of missing data is challenging with categorical estimation methods. Furthermore, the literature suggests that MLE for CFA with items in four categories and moderate asymmetric sample distribution have acceptable levels of (downward) bias for factor correlations (Rhemtulla et al., 2012).

RQ2: Full Structural Model for Bidirectional Associations

Once the longitudinal measurement invariance of the AtL scale was confirmed, we addressed research question 2, which pertains to how academic skills and subconstructs of AtL are associated with each other over time. We examined the reciprocal relationships between the AtL and academic domains over time, building on the cross-lagged model used by Wolf and McCoy (2019). Specifically, we fit full structural models with the latent variables for AtL based on a retained invariance model, while utilizing observed literacy and numeracy scores. We accounted for auto-lagged pathways between the same domains measured across time (e.g., SR at Time 1 predicting SR at Time 2), as well as cross-lagged pathways between different domains across time (e.g., SR at Time 1 predicting literacy at Time 2). Considering our focus on reciprocal relationships between AtL and academic skills, rather than those between academic

skills, we opted not to include the cross-lagged path from literacy to numeracy and vice versa. We also included the covariates listed above as predictors of all Time 2 and Time 3 skills. Covariances of all exogenous variables were freely estimated, with the exception of those from indicators for treatment assignment whose covariances were fixed to 0. We also included error covariances across domains within each time point to better account for potential shared measurement errors. To address missing data (missingness ranged from 0.13% on the school district indicators to 52.81% on the number of books in the home), we once again used FIML with robust standard errors and scaled test statistics. We clustered standard errors to account for the nested structure of the data (students within schools). The same criteria for model fit used in CFA were applied in evaluating the model fit of these structural models.

Transparency and Openness

The data from the QP4G study have been made publicly available at the World Bank's Microdata Library and can be accessed at https://doi.org/10.48529/2yxg-5780.

Results

RQ1: Factor Structure of the AtL Scale

As a first step in addressing research question 1 concerning the dimensionality of the IDELA AtL scale, we classified the IDELA AtL items into theoretically distinguishable dimensions drawn from the SEL taxonomy project (Jones et al., 2021), as indicated in Table 1. Items 1 (attention), 3 (concentration), and 4 (carefulness/accuracy) were categorized as reflecting Self-Regulation Skills (SR), while items 2 (confidence), 5 (pleasure), 6 (motivation/persistence), and 7 (curiosity) were categorized as reflecting Motivation. The SR and Motivation dimensions, respectively, are related to "Skills and Competencies" and "Belief Ecology" in the SEL

taxonomy (Jones et al., 2021) and correspond to the ability and inclination components of the concept of dispositions (Perkins et al., 1993, 2000). Some items were hypothesized to tap into both dimensions. Specifically, we speculated that the likelihood of dual loading was high for item 4, as the second part of the item, "interested in accuracy," may reflect mainly on SR and secondly on Motivation.

In empirically examining research question 1, we analyzed the basic properties of the IDELA AtL items, as summarized in Table 2. All items had similar means (2.99-3.17) and standard deviations (0.85-0.93), with a possible range of 1 to 4. The item-total and item-domain correlations were high across items, with the range from .77 to .84 and from .80 to .88, respectively, suggesting an adequate level of internal coherence. Items tended to be more strongly correlated with other items within the dimensions than across the dimensions. However, item 4 is an exception, and it does not have a clear within- and across-dimensions pattern. Specifically, item 4 shows stronger correlations with items 1 and 3 in the SR dimension than item 7 in the motivation dimension.

Table 3 shows the results (standardized factor loadings) of the EFA. Factors 1 and 2 corresponded with the theoretically specified dimensions of AtL: SR and Motivation. Consistent with the content analysis, item 4 loaded on both SR (.451) and Motivation (.439). Item 2 also showed a sizable loading on SR (.237), although its loading on Motivation was found to be much stronger (.640).

Items loading on more than one factor can make the boundary of the constructs ambiguous. However, the literature suggests that allowing certain items to cross-load may better capture the nature of early development, also possibly leading to good discriminant validity

(Waldman et al., 2021). Therefore, instead of excluding items that load on two factors, we considered such findings as evidence supporting factor models with cross-loading.

Guided by the findings from the content analysis and EFA, we fit a two-factor CFA with cross-loadings among items that were theoretically and/or empirically found to cross-load on both SR and Motivation factors: items 2 (confidence), 4 (carefulness/accuracy), and 6 (motivation/persistence). We compared this two-factor cross-loading model against a one-factor unidimensional model. Table 4 reports the fit indices of the unidimensional model. The results suggest that the model did not fit well in terms of the RMSEA (.123) or the CFI (.924).

Table 4 also shows that the two-factor cross-loading model fit the data well (CFI = .999, RMSEA = .013, and SRSM = .006). This model was also found to be better in its fit compared to the one-factor unidimensional model ($\chi^2(4) = 346.95$, $p < .001$). Figure 1 presents the standardized factor loadings of the two-factor cross-loading model. As expected from the findings of the content analysis and EFA, two items for each factor demonstrated strong and exclusive loadings on their respective factors, whereas three items that cross-loaded exhibited relatively weak correlations with both factors.

To examine whether the subconstructs of the IDELA AtL scale were consistent across waves, we next fit longitudinal measurement invariance models based on the confirmed two-factor cross-loading model of AtL. We used items 1 and 5 as the reference items for the SR and Motivation factors, respectively. The configural invariance model, reported in the first row of Table 5, fits well, with acceptable RMSEA (.052) and CFI values (.995), suggesting that the number of factors and the general pattern of item loadings are consistent across time. The second row of Table 5 shows the results for the metric invariance model, in which unstandardized loadings were constrained to be equal across waves. The overall fit of the model to the data was

acceptable (CFI = 0.987 and RMSEA = .070). Although the chi-square difference test indicated that its relative fit was statistically worse than that of the configural invariance model ($\chi^2(16) = 380.10$, $p < .001$), the changes in the CFI (-.008) and the RMSEA (.017) were within the acceptable range. The metric invariance finding indicated that the factors' (co-)variances were comparable across time. Similarly, the results suggested that the overall fit of the scalar invariance model was acceptable (CFI = 0.985 and RMSEA = .067). Although the chi-square difference test once again indicated a significantly better fit for the model in which intercepts were also allowed to vary across time ($\chi^2(10) = 110.84$, $p < .001$), the changes in the RMSEA (.017) and the CFI (-.002) compared to the metric invariance model were negligible. This result suggests that the value of the intercept for each item is consistent across time, allowing for comparisons of the means of factors across time.

RQ2: Full Structural Model Examining Bidirectional Associations between Approaches to Learning and Academic Skills

Using the retained two-factor model of AtL with cross-loadings that was found to demonstrate sufficient evidence for scalar invariance across waves, we moved on to the full structural model to address research question 2, which concerned associations between academic skills and subconstructs of AtL over time. The goodness of fit statistics indicated adequate levels of fit ($\chi^2(543) = 2413.747$, $p < .001$, RMSEA = .037, CFI = .966).

All standardized and unstandardized coefficients for the full structural model are presented in the table in Appendix A. Standardized coefficients are displayed in Figure 2. The patterns of associations of the AtL subconstructs are more or less the same across literacy and numeracy in both directions. Whereas SR skills show positive correlations with subsequent literacy and numeracy skills (with an exception between Time 2 SR and Time 3 literacy), the

motivation dimension of AtL did not significantly predict later academic skills. It is important to note that the magnitudes of associations of the SR dimension of AtL with academic skills are small, with the standardized coefficients ranging from .052 (Time 2 SR with Time 3 literacy) to .156 (Time 1 SR with Time 2 numeracy). These magnitudes of the associations are consistent with those found by Wolf and McCoy (2019) between executive functions (which are conceptually related to the SR dimension of AtL in this study) and subsequent literacy and numeracy skills, with standardized coefficients ranging from .064 to .094.

The associations between earlier academic skills and subsequent AtL were also positive. In particular, both literacy and numeracy skills showed positive and significant correlations with subsequent AtL subconstructs. Specifically, the magnitudes of associations between literacy skills and subsequent SR ranged from .153 to .185, while those with Motivation ranged from .162 to .186. These magnitudes were larger than those observed for numeracy skills, which ranged from .079 to .114 with subsequent SR and from .056 to .085 with Motivation.

Discussion

Scholars have discussed the importance of young children's AtL based on theoretical foundations and empirical evidence demonstrating their association with subsequent academic outcomes. In the current study, we aimed to extend current conceptualizations of AtL by analyzing the dimensionality of the AtL scale from a commonly used measure of early childhood development in global settings – the IDELA – within a sample of Ghanaian children who had recently entered school. Furthermore, to extend our understanding of reciprocality, we explored potential bidirectionality in the relations between our identified subconstructs of AtL and children's academic skills across the first several years of formal schooling. Our content analysis revealed that the IDELA AtL scale consists of two dimensions: Self-Regulation (SR) and

Motivation. The SR and Motivation dimensions, respectively, are described as "Skills and Competencies" and "Belief Ecology" in the SEL taxonomy (Jones et al., 2021) and correspond to the ability and inclination components of the concept of dispositions (Perkins et al., 1993, 2000). These two dimensions are also consistent with the self-regulated learning theory, which posits that proactive engagement in learning requires metacognition and self-regulation skills, as well as the will to deploy such regulative skills (Zimmerman, 1990; Zimmerman & Moylan, 2009). Additionally, our longitudinal measurement invariance analysis suggests that these items capture these latent subconstructs in similar ways as children progress across the first several years of formal schooling.

Our findings imply that although scholars have commonly used single composite measures of AtL (e.g., ECLS-K and EAP-ECDS), such unidimensionality may not always be theoretically or empirically supported. Therefore, researchers employing these existing AtL measures may want to reconsider their factor structure and explore the possibility of multidimensionality. In particular, researchers using the IDELA – which has been applied to measure child development in approximately 100 countries around the world – may consider exploring the extent to which these SR and motivational dimensions could also apply in other contexts. Specifically, our finding with the two-factor cross-loading structure suggests that while each item may not specifically measure one subconstruct, there are two distinguishable underlying latent factors, SR and Motivation, which jointly enable children to instantiate behaviors captured in the items. The literature on early childhood development measurement suggests that a cross-loading pattern is natural, as children execute competencies in different domains to instantiate certain behaviors (Waldman et al., 2021). However, these patterns of joint execution of SR and Motivation in instantiating some behaviors, such as “showing confidence

when completing activities" (AtL2) and "not giving up quickly or wanting to stop the task" (AtL6), do not necessarily imply that the same joint execution is essential for behaviors directly contributing to children's learning in a given context. Therefore, empirical testing is needed to understand how each dimension of AtL functions in supporting children's learning.

Leveraging the two-dimensional conceptualization of AtL, we conducted an analysis using a full structural model to examine how the subconstructs of AtL and academic skills are associated with each other over time. The results showed that children with higher levels of SR early in schooling exhibited, on average, higher literacy and numeracy skills in later grades compared to their peers with low early SR. However, children's motivation in the early grades did not predict subsequent literacy and numeracy skills. The early academic skills and subsequent AtL also exhibited consistent patterns. Specifically, higher literacy and numeracy skills in children at the early grades were predictive of higher levels of subsequent SR and motivation, and the magnitudes of these relationships were sometimes comparable to those observed between the same constructs across two time points (e.g., Time 1 SR to Time 2 SR).

We speculate that there are two possible explanations for the findings regarding the associations of AtL subconstructs and subsequent academic skills. First, the findings suggest that SR may be a more important predictor of children's academic learning in the Ghanaian context when compared to their levels of motivation. In line with the person-environment fit theory, which underscores the match between individual characteristics and the learning environment (McCoy et al., 2014), the absence of associations between the motivation dimension of AtL and subsequent academic skills may reflect the Ghanaian educational environment's prioritization of teacher authority and student compliance over children's intrinsic motivation and curiosity to learn (Akyeampong, 2017). Such educational environments may result from structural factors,

such as a high child-to-teacher ratio and limited professional development opportunities. However, they could also reflect broader values and expectations of teachers, parents, and communities. The difference between “hierarchical relatedness” or socially-oriented values, such as respect, obedience, and cooperation emphasized commonly in a rural communal network, and “psychological autonomy,” related to the primacy of one's own intentions and preferences, valued in urban, educated environments may play an important role in shaping the educational environment (Jukes et al., 2023; Keller, 2016; Serpell, 2011). The educational context, in turn, affects how children are socialized and perceived with regard to their self-motivation within the educational context. For instance, children who actively ask questions driven by intrinsic motivation and curiosity may not be well-received or may even be recognized as deviating from expected socially-oriented norms by both teachers and parents (Lancy, 2014), which may explain why pedagogical reforms in sub-Saharan Africa that aim to promote "learner-centered" approaches have often been unsuccessful (Jukes et al., 2023; Tabulawa, 2013).

However, we caution against interpreting our findings as evidence that learning motivation is unimportant in Ghana or similar contexts in Sub-Saharan Africa. Our study captures a relatively short period of time in early childhood. However, self-regulated and self-motivated learning may be more crucial in later years or in out-of-school learning environments, where external reinforcements to guide children’s learning are less prominent. It may be the case that AtL, in general, and motivation, in particular, play larger roles over time, specifically in learning contexts with fewer external reinforcements. Such a hypothesis was partially supported by a recent study conducted in Côte d’Ivoire with second and fourth-graders, which found that executive function and intrinsic motivation predicted later academic skills (Finch et al., 2022). In addition to more longitudinal work, future studies need to examine possible ways in which

teachers can be empowered to leverage students' learning potential for effective and sustainable engagement in learning in a way that does not conflict with socially oriented values emphasized in the context.

The second possible explanation is that, while both SR and motivation are substantively important, the IDELA AtL scale has larger limitations in capturing children's motivation conducive to learning. McCoy (2019) discusses the advantages and disadvantages of different types of early childhood measurements, including direct assessments, adult reports, and observational tools. How these types of measurements are related to each other and to academic skills has been studied with a sample of primary school students in Ghana (Ahmed et al., 2022). Although these studies primarily focus on SR measurements, the same principles can be extended to analyze the motivation dimension of the IDELA AtL scale. Notably, the relationship between the child and assessors can have significant implications. Compared to adult reports commonly used for measuring young children's AtL (e.g., ECLSK, EAP-ECDS), observation by trained IDELA assessors is less susceptible to subjectivity, social desirability bias, and measurement errors stemming from prior information about other characteristics of the child. However, as the assessors are not familiar with children's typical behaviors, they may not capture children's behaviors across various situations and settings, possibly leading to a less generalizable perspective on children's motivation compared to reports by familiar adults. Additionally, the presence of unfamiliar adults (or the absence of familiar adults and peers) may influence the behavioral manifestations of internal motivation, and these effects may be more pronounced for shy children. Furthermore, explicit encouragement or stimulation to elicit children's motivation and curiosity through behavioral manifestation, as used in some direct assessments (Engel, 2011; Jirout & Klahr, 2012), was lacking in the IDELA. Without explicit

encouragement or stimulation, children's internal motivation and curiosity might remain unexpressed during the IDELA administration.

Additionally, the content of the IDELA AtL items may fail to tap into specific motivational concepts that are particularly important in this context. Ryan and Deci (2000) discuss how autonomy, a key psychological factor underlying intrinsic motivation, is often conflated with being self-contained, self-reliant, and unique. Instead, autonomy in self-determination theory refers to the feeling of volition that drives any act, whether dependent or independent, collectivist or individualist Ryan & Deci, 2000). Keller (2016) emphasizes that the understanding of autonomy is socialized during everyday experiences, suggesting contextually varying forms of autonomy. The lack of associations between the motivation dimension of the IDELA AtL scale and academic skills may be due to its inability to tap into more socially oriented autonomy-driven motivation that better fits the values in the Ghanaian context. As such, the ecological validity, or the ability to capture the ways that children deploy their motivation in the real-world learning context (McCoy, 2019), may be limited in the IDELA AtL scale. Some items in existing AtL measures, like "Help with chores" in the ECLS-K AtL scale, may be linked to socially-oriented autonomy-driven motivation. Therefore, it is worth testing the functionality of this item and other relevant items in LMIC contexts.

Limitations

In addition to the potentially limited ecological validity of the motivation dimension of the IDELA AtL scale, we note a few limitations in the current study. First, the IDELA AtL scale may generally have measurement errors due to the lack of standardized operational definitions of the skills and dispositions it aims to measure, likely resulting in scores with limited objectivity and conceptual precision. Further investigation into inter-rater reliability and test-retest reliability

is necessary, and comprehensive measurement studies may inform more reliable and ecologically valid AtL measurement development. An additional limitation of using the IDELA AtL scale is that it included items only reflecting children's SR and motivation. While these two dimensions have theoretical underpinning, AtL has been conceptualized to include a wide range of abilities and inclinations, including not just SR and motivation, but also constructs such as curiosity and creativity. Future work is needed to expand measures of AtL to include these constructs guided by relevant theories, as well as to consider additional AtL-related competencies that may be unique to non-Western contexts. Additionally, we note that findings provide evidence for correlation, but not causation. Specifically, children's other unobserved skills may confound the associations between AtL subconstructs and academic skills. Lastly, the sample is not representative of all children in Ghana or Sub-Saharan Africa. Therefore, while this study contributes to the AtL literature by adding evidence from an understudied context outside of the widely studied Western context, the extent to which our findings can be generalized to other Sub-Saharan African countries or more broad LMICs is unknown and likely limited.

Conclusion

By combining content and empirical analyses, we aimed to generate a more conceptually precise and empirically valid approach for capturing different subconstructs of AtL in the early grades. Our study reveals that the SR dimension of AtL is positively associated with subsequent academic skills, whereas the motivation dimension demonstrates no such correlations. While we cannot rule out the possibility of such findings being due to measurement limitations, particularly regarding the ecological validity of the motivation subconstruct of the IDELA AtL scale, our results nonetheless imply the necessity of applying more nuanced conceptualizations of AtL that consider the different ways in which its subconstructs might relate to learning across time and

setting of AtL. Our findings also motivate future studies to systematically investigate factors underlying the variation in what constitutes AtL conducive to various learning outcomes, both in terms of structural and social-cultural factors. For instance, it is worth examining whether social-cultural values might moderate the associations between AtL subconstructs and academic skills through cross-national studies. Collectively, this more specific approach to operationalizing and understanding AtL will help promote effective and sustainable engagement in learning in a culturally appropriate way.

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Table 1. IDELA Approaches to Learning Scale Items

	Item	Theoretical dimension
AtL1	Did the child pay attention to the instructions and demonstrations throughout the assessment?	SR
AtL2	Did child show confidence when completing activities; did not show hesitation.	Motivation
AtL3	Did the child stay concentrated and on task during the activities and was not easily distracted?	SR
AtL4	Was child careful and diligent on tasks? Was child interested in accuracy?	Motivation + SR
AtL5	Did child show pleasure in accomplishing specific tasks?	Motivation
AtL6	Was child motivated to complete tasks? Did not give up quickly or want to stop the task?	Motivation + SR
AtL7	Was the child interested and curious about the tasks throughout the assessment?	Motivation

Table 2. Means, SD, and Item-Total, Item-Domain and Inter-item Correlations (Polychoric) for Approaches to Learning Items

	SR		Motivation				
Item	AtL1	AtL3	AtL2	AtL4	AtL5	AtL6	AtL7
Mean (1-4)	3.17	3.10	3.09	2.99	3.09	3.15	3.03
SD	0.87	0.86	0.88	0.91	0.89	0.85	0.93
Item-Total	0.77	0.83	0.79	0.84	0.84	0.83	0.80
Item-Domain	0.82	0.82	0.83	0.80	0.88	0.84	0.83
AtL3	*0.85*						
AtL2	0.73	0.72					
AtL4	0.77	0.78	*0.79*				
AtL5	0.66	0.68	*0.83*	*0.78*			
AtL6	0.70	0.71	*0.79*	*0.78*	*0.84*		
AtL7	0.62	0.65	*0.77*	*0.74*	*0.84*	*0.81*	

Note: Interitem Correlations within the same dimension in italics. Item-Total indicates correlations between each item and the total scores consisting of the seven items, while Item-Domain indicates correlations between each item and domain scores.

Table 3. Results of Exploratory Factor Analysis for Approaches to Learning Items (*n* = 1717)

Item	Assigned theoretical dimension	Factor 1 (SR)	Factor 2 (Mot)
AtL1 Attention	SR	*0.940*	-0.083
AtL3 Concentration	SR	*0.870*	-0.003
AtL2 Confidence	Motivation	0.246	*0.620*
AtL4 Carefulness	Motivation (SR)	*0.468*	*0.411*
AtL5 Pleasure	Motivation	-0.087	*0.971*
AtL6 Mot & Perst	Motivation (SR)	0.165	*0.712*
AtL7 Curiosity	Motivation	-0.056	*0.905*
Proportion of explained variance		0.267	0.408

Note: Standardized factor loadings >.30 shown in italics.

Table 4. Summary of Goodness of Fit for Confirmatory Factor Models of Approaches to Learning Items (*n* = 1710)

Model	χ^2 (df)	CFI	RMSEA	SRSM	χ^2-diff (df)	p-value
One-Factor	376.43 (14)	0.924	.123 (.115, .131)	.044		
Two-Factor Cross-Loading	13.08 (10)	0.999	.013 (.000 .027)	.006	346.95 (4)	<.001

Table 5. Summary of Fit Statistics for Measurement Invariance of the Two-Factor Model of Approaches to Learning with Cross-Loadings

Invariance model	χ^2(df)	CFI	RMSEA	Model comparison	χ^2-diff (df)	p-value	Δ RMSEA	Δ CFI
1. Configual	182.053 (30)	0.995	.052 (.045, .059)	NA				
2. Metric	505.876 (46)	0.987	.070 (.064, .075)	2 vs. 1	380.10 (16)	<.001	0.017	-0.008
3. Scalar	616.425 (56)	0.985	.067 (.062, .072)	3 vs. 2	110.84 (10)	<.001	-0.002	-0.002

Note: Sample size = 3,434 (Time 1), 3,407 (Time 2), and 3,126 (Time 3).

Figure 1. Two-Factor Cross-Loading Model of Approaches to Learning with Standardized Factor Loadings

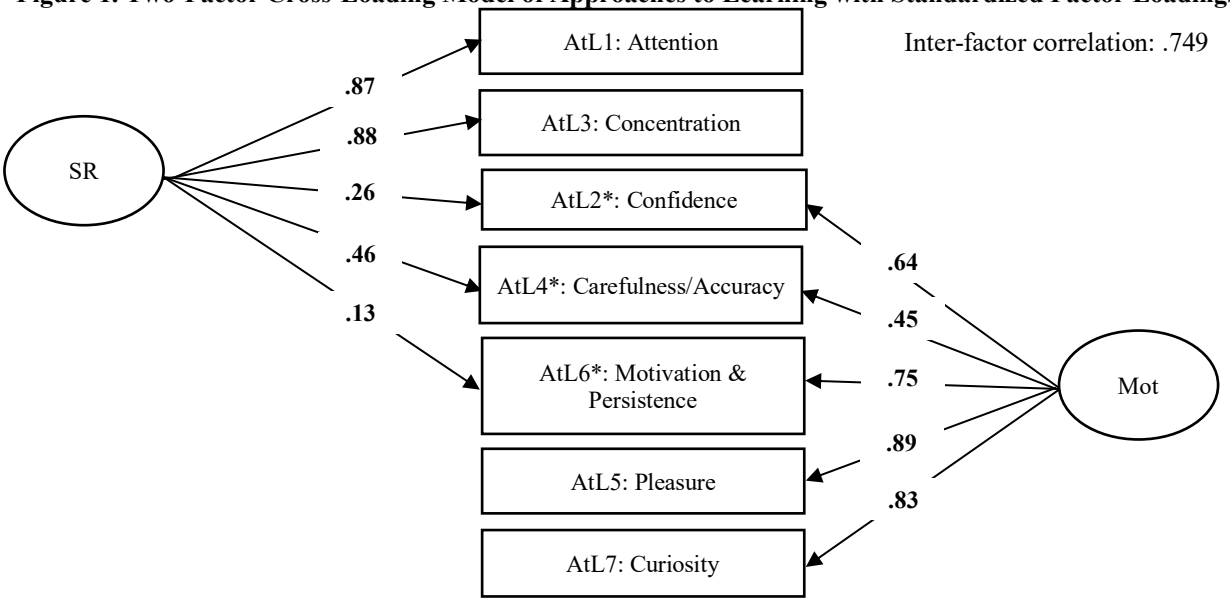
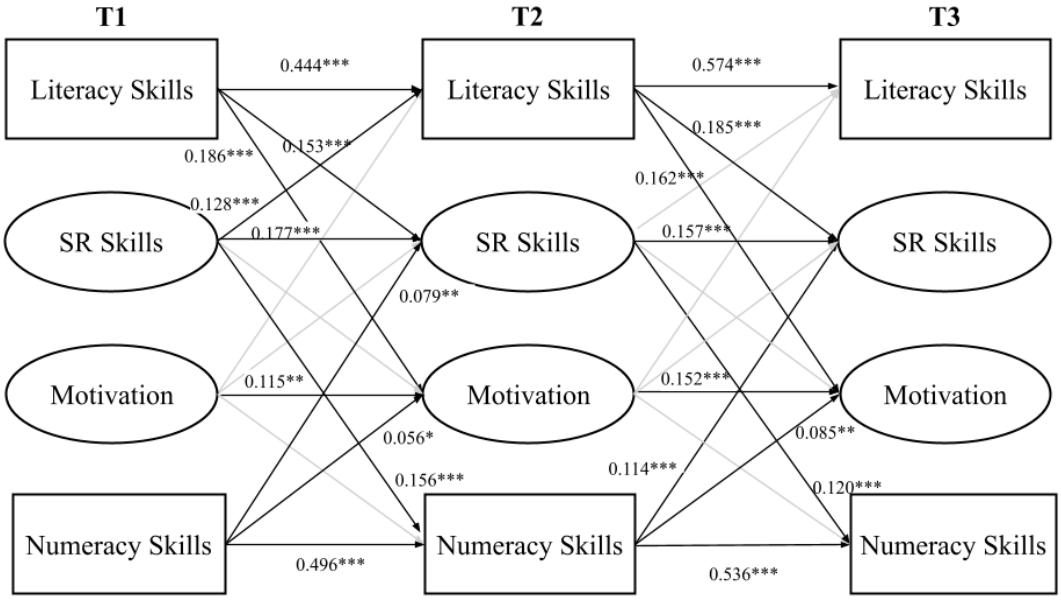


Figure 2. Standardized Coefficients from the Full Structural Model Examining Approaches to Learning and Academic Skills Over Time



Note: Sample size = 3,862. Variances and covariances of all exogenous variables, including the above-mentioned covariates, were freely estimated, with the exception of covariances with treatment assignment. *** $p<.001$, ** $p<.01$, * $p<.05$.

Appendix A. Results of the Full Structural Model

	b	S.E	*p*-value	beta
Fall 2015 (T1) → Spring 2016 (T2)				
Literacy				
Lit → Lit	0.403	0.018	<.001***	0.444
SR → Lit	0.037	0.010	<.001***	0.128
Mot → Lit	0.004	0.007	0.617	0.015
Numeracy				
Num → Num	0.466	0.017	<.001***	0.496
SR → Num	0.041	0.009	<.001***	0.156
Mot → Num	-0.003	0.007	0.632	-0.015
Self-Regulation				
Lit → SR	0.434	0.088	<.001***	0.153
Num → SR	0.250	0.082	0.002**	0.079
SR → SR	0.158	0.037	<.001***	0.177
Mot → SR	-0.023	0.027	0.384	-0.009
Motivation				
Lit → Mot	0.614	0.097	<.001***	0.186
Num → Mot	0.205	0.103	0.047*	0.056
SR → Mot	-0.009	0.042	0.825	-0.021
Mot → Mot	0.101	0.034	0.003**	0.115
Spring 2016 (T2) → Spring 2017 (T3)				
Literacy				
Lit → Lit	0.512	0.018	<.001***	0.574
SR → Lit	0.015	0.009	0.100	0.052
Mot → Lit	0.008	0.008	0.311	0.033
Numeracy				
Num → Num	0.458	0.016	<.001***	0.536
SR → Num	0.030	0.008	<.001***	0.120
Mot → Num	0.006	0.007	0.351	0.029
Self-Regulation				
Lit → SR	0.573	0.086	<.001***	0.185
Num → SR	0.381	0.079	<.001***	0.114
SR → SR	0.155	0.032	<.001***	0.157
Mot → SR	-0.027	0.026	0.314	-0.031
Motivation				
Lit → Mot	0.650	0.122	<.001***	0.162
Num → Mot	0.366	0.104	<.001***	0.085
SR → Mot	0.002	0.048	0.959	0.002
Mot → Mot	0.167	0.041	<.001***	0.152

Note: Sample size = 3,862. Covariances of all exogenous variables, besides indicators for treatment assignment, were freely estimated. *** $p<.001$, ** $p<.01$, * $p<.05$.

Supplementary files

Table S1. Conceptual mapping of IDELA AtL scale items based on the SEL taxonomy framework

	Item	Relevant construct	Explore SEL domain (Subdomains): Based on the description of domains/subdomains	Related terms (framework)	Explore SEL domain (Subdomains): 1	Explore SEL domain (Subdomains): 2	Explore SEL domain (Subdomains) : 3
1	Did the child pay attention to the instructions and demonstrations throughout the assessment?	Attention	Cognitive Skills (Attention Control)	child maintains focus and sustains attention with minimal adult support (Head Start)	Cognitive Skills (Attention Control)	Values (Performance Values)	
				managing attention and behavior (K-3 SEL Standards (Connecticut))	Cognitive Skills (Attention Control)	Values (Performance Values)	
2	Did child show confidence when completing activities; did not show hesitation.	Confidence	Identity (Self-Efficacy/Growth Mindset); Values (Performance Values)	self-efficacy (Building Blocks for Learning)	Identity (Self-Efficacy/Growth Mindset)		
				self-efficacy (OECD)	Identity (Self-Efficacy/Growth Mindset)		
3	Did the child stay concentrated and on task during the activities and was not easily distracted?	Concentration	Cognitive Skills (Attention Control; Inhibitory Control)	self-control (OECD)	Cognitive Skills (Attention Control; Inhibitory Control; Working Memory and Planning Skills)	Values (Performance Values)	
				cognitive and impulse control (SEE Learning Framework)	Cognitive Skills (Attention Control)		
				inhibitory control (MELQO)	Cognitive Skills (Attention Control; Inhibitory Control)		

4	Was child careful and diligent on tasks? Was child interested in accuracy?	Carefulness/Accuracy	Values (Performance Values); Cognitive Skills (Inhibitory Control)	striving for accuracy and precision (Habit of Mind)	Values (Performance Values; Intellectual Values)	Identity (Self-Efficacy/Growth Mindset)	
5	Did child show pleasure in accomplishing specific tasks?	Pleasure	Values (Performance Values; Intellectual Values)	motivation to mastery (Developmental Assets (ages 3-5))	NA		
				achievement motivation (The PRACTICE Model)	Identity (Self-Efficacy/Growth Mindset)	Values (Performance Values; Intellectual Values)	
				curiosity (OECD)	Values (Intellectual Values)		
				responding with wonderment and awe (Habit of Mind)	Identity (Self-Efficacy/Growth Mindset)	Values (Performance Values; Intellectual Values)	Perspectives (Enthusiasm/ Zest)
6	Was child motivated to complete tasks? Did not give up quickly or want to stop the task?	Motivation/Persistence	Values (Performance Values); Cognitive Skills (Attention Control)	child persists in tasks (Head Start)	Values (Performance Values)		
				persistence (within "sustaining effort" subdomain ACT Holistic Framework)	Values (Performance Values; Intellectual Values)	Cognitive Skills (Inhibitory Control)	
				persistence (OECD)	Values (Performance Values)		
7	Was the child interested and curious about the tasks throughout the assessment?	Curiosity	Values (Performance Values; Intellectual Values); Perspectives (Enthusiasm/Zest)	curiosity (Building Blocks for Learning)	Values (Intellectual Values)		
				achievement motivation (Developmental Assets (ages 5-9))	NA		
				child shows interest in and curiosity about the world around them (Head Start)	Values (Performance Values)		

We categorized each IDELA AtL item into conceptual domains and subdomains based on the social-emotional learning (SEL) taxonomy framework (Jones et al., 2021). The relevant domains included: Cognitive Skills (including Attention Control, Inhibitory Control, and Working Memory and Planning Skills subdomains), Values (including Performance Values and Intellectual Values subdomains), Perspectives (including Enthusiasm/Zest subdomain), and Identity (including Self-Efficacy/Growth Mindset subdomain). We verified our categorization of the IDELA items by cross-checking how similar constructs from various SEL frameworks were coded by the trained coders involved in the taxonomy project (The EASEL Lab, n.a.; see columns 5-8).