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Online First Publication, July 1, 2019. http://dx.doi.org/10.1037/emo0000640

AMERICAN PSYCHOLOGICAL ASSOCIATION

Emotion


1528-3542/19/$12.00

http://dx.doi.org/10.1037/emo0000640

# Cascades of Infant Happiness: Infant Positive Affect Predicts Childhood IQ and Adult Educational Attainment

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Parents want their children to be happy, educated, and successful, but are these goals related? People assume that success leads to happiness, but research on adults supports a reverse conceptualization: Happy people are more successful. Is happiness during childhood also linked to later success? Across the lifespan positive affect is linked with expanded cognitive abilities, learning, and resource building that can be adaptive and useful such that it leads to more success. Conversely, ongoing negative affect can reduce opportunities for growth and learning. Thus, happiness at any age may predict future success. Yet, no research has examined if positive and negative affect during infancy predicts childhood cognitive abilities and adult academics success. In a community sample, I hypothesized that higher infant positive affect (but not negative affect) would predict higher childhood cognitive abilities (i.e., IQ) and adult academic success (i.e., education attainment) in a 29-year study ($n$ = 130). Positive affect, but not negative affect, during infancy (age 1.5), directly predicted higher childhood IQ (ages 6–8) and higher educational attainment (age 29), even after controlling for family socioeconomic status and infant intelligence. Childhood IQ partially explained the link between positive affect during infancy and adult educational attainment. This study advances understanding of how happiness during infancy (before formal education has begun) is linked to gold standard indicators of cognitive abilities and adult academic success. Parents, educators, and policymakers may want to place a higher value on early affective experiences when considering educational success.

*Keywords:* happiness, academic attainment, success, intelligence, lifespan development



The days that make us happy make us wise.

—John Masefield

Parents want their children to be happy, educated, and successful (e.g., Diener & Lucas, 2004; Wittenberg, Beverung, Ansari, Jacobvitz, & Hazen, 2017; Young, Davis, Schoen, & Parker, 1998), but are these goals related? Often people believe that education, success, and other desirable life circumstances will bring happiness (e.g., Michalos, 2008; Witter, Okun, Stock, & Haring, 1984), but longitudinal and experimental studies demonstrate the reverse: Happiness leads to success (for a review, see Lyubomirsky, King, & Diener, 2005). Although happiness has biological links (e.g., genetics), it is also influenced by situational stimuli in the environment (Gray & Watson, 2001; Lyubomirsky, Sheldon, & Schkade, 2005) such that interventions promote greater happiness (Flook, Goldberg, Pinger, & Davidson, 2015; Kok et al., 2013; Lyubomirsky & Layous, 2013; Nelson, Layous, Cole, & Lyubomirsky, 2016; Nelson-Coffey, Fritz, Lyubomirsky, & Cole, 2017). As most of this happiness research has centered on adults, a gap exists in understanding how happiness during childhood relates to success. Specifically, what is the earliest age that happiness is linked to adult success?

Happiness during infancy and childhood may be just as important as happiness during adulthood for initiating cascades of success and well-being (Coffey, 2018; Davis & Suveg, 2014). A primary marker of childhood success—education—is linked to earlier intellectual abilities, such as cognitive abilities and IQ (Abe & Izard, 1999; Ritchie & Tucker-Drob, 2018) and nonintellectual factors, such as emotions, emotion regulation, and relationship quality (e.g., Abe & Izard, 1999; Coffey, Wray-Lake, Mashek, & Branand, 2016; Dindo et al., 2017; Duyme, Dumaret, & Tomkiewicz, 1999; Davis & Suveg, 2014; Moffitt et al., 2011). As with happiness (Lyubomirsky, King, et al., 2005), intelligence and education are also linked to future success and well-being (Alloway & Alloway, 2010; Calvin et al., 2017; Lynn, 2010; Lynn & Mikk, 2009; Montez & Barnes, 2016; Ritchie & Tucker-Drob,

This experiment uses archival data from as far back as 1979 and was not formally preregistered. Permission for using the Fullerton Longitudinal Study (FLS) data is required to limit researchers using the data for the same topic and to protect participant privacy because the study continues to collect data. As such, neither data nor materials have been made available in a third-party archive. E-mail John K. Coffey to request data or materials.

The FLS has been supported by grants from the Thrasher Research Fund; Spencer Foundation; California State University, Fullerton; California State University, Northridge; Kravis Leadership Institute; BLAIS Foundation; W. K. Kellogg Foundation; and Army Research Institute (W911NF-17-1-0220). I thank all FLS participants for their continuous involvement in this investigation. Special thanks to Allen Gottfried, Katherine Nelson-Coffey, and the whole FLS team. The findings, interpretations, and conclusions contained in this article are exclusively those of the author.

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2018; Vaillant & Mukamal, 2001). Together, this evidence suggests that happiness, intellectual abilities, and success are connected, but these studies have not linked happiness in infancy to long-term cognitive abilities and adult educational success. In this study, I tested associations between happiness during infancy and objective measures of intelligence during childhood and adult academic success.

## Defining Infant Happiness

Happiness during infancy is measured by examining frequency of positive affect and infrequency of negative affect (e.g., Coffey, Warren, & Gottfried, 2015). Notably, positive and negative affect are considered independent constructs with distinct adaptive purposes rather than two ends of one continuum (Abe & Izard, 1999; Coffey, 2018; Coffey et al., 2015; Fredrickson, 2013). Studies have indicated weak to moderate inverse associations between positive and negative affect (Coffey et al., 2015; Diener & Emmons, 1984; Fredrickson, 2013). In low risk samples, people of all ages experience more positive than negative affect (Abe & Izard, 1999; Coffey et al., 2015; Trampe, Quoidbach, & Taquet, 2015), which allows individuals to physiologically downregulate, explore, learn, and build or restore resources to deal with future adversity associated with negative affect (Coffey, 2018; Fredrickson, 2013; Porges, 2007). Further, positive and negative affect can be experienced at the same time (e.g., Trampe et al., 2015). For example, infants might be happy to see their parents when they pick them up from daycare but sad to leave. Distinguishing between the two is useful even in infancy because they have different antecedents and consequences (e.g., Belsky, Domitrovich, & Crnic, 1997; Belsky, Fish, & Isabella, 1991; Belsky, Hsieh, & Crnic, 1996; Coffey et al., 2015; Gray & Watson, 2001; Izard, Huebner, Risser, & Dougherty, 1980). Given the independence of positive and negative affect and their distinctive adaptive purposes (detailed below), I examined how both were associated with later cognitive abilities and educational success.

## Why Are Happier Infants More Successful Adults?

The broaden-and-build theory offers a theoretical foundation linking happiness to success (Fredrickson, 2013). According to this theory, experiencing positive affect broadens thought processes (e.g., think more creatively, increase exploration), which allows people to build resources (e.g., skills, relationships, knowledge) they can use later (Fredrickson, 2013). Further, more frequent positive affect signifies things are going well and allows individuals to set goals that expand their own understanding and resources (Lyubomirsky, King, et al., 2005). Reviews of this literature focusing separately on infancy, childhood, and adulthood indicate that higher rates of positive affect predicted a range of useful resources such as more creativity, problem-solving skills, advanced cognitive abilities, prosocial behaviors, and social skills in cross-sectional, longitudinal, and experimental studies (Abe & Izard, 1999; Coffey, 2018; Davis & Suveg, 2014; Fredrickson, 2013; Isen, Daubman, & Nowicki, 1987; Lyubomirsky, King, et al., 2005), but most of the studies in these reviews did not range from infancy to adulthood. By linking infancy to adulthood, this study will help to determine if positive affect during infancy (and associated resource building) has enduring benefits, given that what is helpful in the short-term is not always adaptive in the long-term (e.g., Coffey, 2018). In summary, the more humans (of all ages) experience positive affect the more opportunities they will have to learn and build cognitive resources central to intelligence and instrumental to long-term success.

Although negative affect can be adaptive for survival and protecting resources over short periods of time (Frijda, 1986), it may also result in limited exploration that could reduce opportunities for cognitive growth. Specifically, negative affect constricts thinking and focus to preserve resources and quickly alleviate distress through responses like fight or flight (e.g., Abe & Izard, 1999; Frijda, 1986). For example, when infants are distressed, they retreat to caregivers for safety, comfort, and relief to avoid increased risk or distress. Rather than trying to explore or learn new things in an uncertain situation, they prioritize alleviating fear and feeling safe before they return to exploring (Ainsworth, 1979). In low-risk samples with limited negative affect (and higher positive affect) that is typically resolved quickly, negative affect may not have lasting implications for learning.

Even though most of the happiness research including positive affect has been conducted with adults, affect during infancy should have age appropriate similarities to affect during adulthood. Primarily, experiencing more positive affect during infancy should result in more chances to broaden and build, whereas high levels of negative affect will reduce these opportunities (Coffey, 2018). When infants feel safe, comfortable, or happy, they are more likely to explore their environment and to engage with others in ways that develop lasting cognitive and social skills (Abe & Izard, 1999; Ainsworth, 1979; Coffey, 2018), which could result in better cognitive abilities reflected in IQ scores and more long-term success. Thus, infants who experience more positive affect would build more cognitive abilities central to academic success. Conversely, high levels of negative affect during infancy may reduce these chances for growth and learning but low levels of negative affect may not impede long-term learning. For example, all infants will experience some negative affect but if it is generally alleviated or short-term, negative affect is less likely to have long-term implications for learning that are found in high-risk samples that experience frequent or ongoing negative affect. Given that prior research has linked positive affect to long-term benefits and negative affect to short-term consequences in community samples, I hypothesized that positive affect, but not negative affect, would be associated with long-term educational success.

Recognizing the distinct adaptive purposes and consequences of positive and negative affect, higher happiness during infancy has the potential to initiate a cascade of resource and skill building that predicts academic success. Although this has not been directly tested, indirect evidence supports this idea. In preschoolers, a 12-week intervention designed to promote kindness was associated with better grades and well-being at the end of the year (Flook et al., 2015). A longer study linked socioemotional skills (but not happiness) at age 3 to educational achievement at age 15 (Dindo et al., 2017). A 3-year study of college students found associations between happiness and other markers of academic success like grades (Coffey et al., 2016). Recent studies indicate that in low-risk populations (who experience infrequent negative affect), positive affect and what is going well are more likely to predict future success and well-being than negative affect and adversity (e.g., Coffey et al., 2015, 2016; Kok et al., 2013; Vaillant & Mukamal, 2001). Although these studies offer indirect evidence that early happiness might predict academic success, they do not provide direct evidence about how affect during infancy might be related to cognitive abilities central to adult academic success.

In addition, happiness levels in infants might predict later cognitive abilities like IQ that are associated with academic success (e.g., Alloway & Alloway, 2010; Lynn, 2010; Lynn & Mikk, 2009; Ritchie & Tucker-Drob, 2018). Longitudinal studies directly linking happiness and IQ are rare, but a range of studies suggest that environmental factors—which likely result in differences in positive and negative affect—are associated with IQ scores (e.g., Duyme et al., 1999; for a review, see Sauce & Matzel, 2018). A recent review of IQ research found a high level of gene–environment interplay such that large circumstantial improvements like adoption (from orphanages to stable homes) or immigration (to better living conditions) were associated with increases in IQ in a range of samples (Sauce & Matzel, 2018). Another study found that educational experiences predicted higher IQ (Ritchie & Tucker-Drob, 2018). Conversely, indicators of environmental adversity (e.g., low socioeconomic status [SES] and neglect)—likely resulting in infrequent positive affect and frequent negative affect—have been linked to lower IQ (Duyme et al., 1999; Gottfried, Gottfried, & Guerin, 2006; Sauce & Matzel, 2018). Although these environmental factors likely resulted in differences in affective frequency, no research has examined how both positive affect and negative affect during infancy predicts later IQ.

These findings also suggest the importance of distinguishing the roles of positive and negative affect from known predictors of IQ and educational attainment. First, SES (as measured in this article)—including parents' education, occupation, and marital status—is important because it encompasses many factors related to children's success (Gottfried, 1985). For example, prior research has linked parent SES to child achievement via parenting behaviors and resources (e.g., Davis-Kean, 2005). Furthermore, higher SES may enable caregivers to provide resources (e.g., tutoring, better schools) for their children that may confer benefits for long-term educational success. Thus, parent SES represents an important covariate that encompasses numerous resources that would promote academic success. Furthermore, although sex has not been linked to differences in IQ (Lynn & Irwing, 2004), women pursue higher education and attain college degrees more frequently than do men (e.g., Krapohl & Plomin, 2016; Sirin, 2005). Early intelligence is also an indicator of later intelligence and academic success (e.g., Yu, McCoach, Gottfried, & Gottfried, 2018). In the current study, I distinguish the effects of happiness during infancy on educational attainment from these known predictors of education and IQ—namely, parent SES (a broad indicator of numerous resources provided for children), sex, and early indicators of intelligence.

Finally, most of these studies focus on affect and IQ after formal education begins (e.g., Ritchie & Tucker-Drob, 2018)—adding educational confounds and questions about directionality—and most did not continue until formal education ended. Preschools and schools are designed to cultivate intellectual and cognitive skills, so measuring happiness before children begin school can eliminate the confounding effects of formal education. Further, ending studies before people complete their formal education requires a focus on more proximal outcomes (e.g., grades) that are not as central to long-term success and well-being as overall educational attainment.

## Cascades of Infant Happiness to Childhood IQ and Educational Attainment

Given the limited research on early life happiness, little is known about how positive and negative affect during infancy connects to adult educational attainment. Further, no studies have examined if positive and negative affect during infancy uniquely predict differences in childhood IQ that might help explain why early affect is linked to adult educational attainment. This 29-year study is the first that followed a community sample to determine if infant happiness was linked to childhood IQ and adult educational attainment. Further, I sought to distinguish the role of positive affect during infancy from other known predictors of cognitive ability and educational attainment—namely, SES, sex, and infant intelligence (e.g., Krapohl & Plomin, 2016; Sirin, 2005). Given the low-risk nature of this sample (as indicated by prior reports of lower levels of negative affect in this sample; Coffey et al., 2015) and that positive affect builds lasting resources, when examining both positive and negative affect, I hypothesized that higher positive affect (H1a) but not lower negative affect (H1b) during infancy would predict higher age 29 education attainment after adjusting for sex and parent SES. To help understand this link, I examined cognitive abilities indicated by childhood IQ. Given the low-risk nature of this sample and the exploration and learning associated with positive affect, I hypothesized that higher positive affect (H2a) but not lower negative affect (H2b) during infancy would predict higher childhood IQ after adjusting for sex and parent SES. In addition, I predicted a partially mediated path from positive affect to higher adult educational attainment via childhood IQ (H3; See Figure 1).

# Method

## Participants

This study used all participants ($N$ = 130; 47.7% female) from archival data in the Fullerton Longitudinal Study (FLS). The FLS consists of a community sample of families and their children. Participants were recruited using birth notifications provided by Southern California hospitals for babies born be-

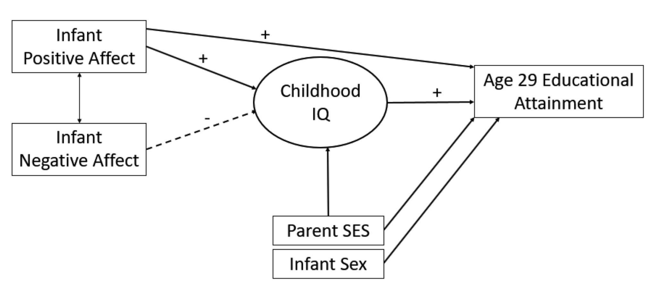


*Figure 1.* Hypothesized prediction model using positive and negative affect during infancy as predictors of childhood IQ and adult educational attainment after accounting for sex and parent socioeconomic status (SES). Dotted lines are not expected to be significant.

tween August and December of 1978. All families spoke English. Most mothers (93.1%) reported being married. Data collection began when parents of infants (age 1) were recruited to participate, and follow-up data for this study were collected throughout their childhood and then again at ages 24, 29, and 38. Each step of data collection was approved by one or more university institutional review boards. To participate, infants were required to be full-term, normal birth weight, and free of visual and neurological abnormalities at birth (Gottfried et al., 2006). Retention was high with over 80% participation in each wave. The sample was mostly Caucasian (90%) with diverse parent occupations ranging from semiskilled to professional (representative of the local population at the beginning of the study). Extensive attrition analyses found no differences those who continued to participate and those who did not (Guerin, Gottfried, Oliver, & Thomas, 2003; Gottfried et al., 2006).

## Procedure and Longitudinal Design

The current research includes all 130 participants (47.7% female) from the FLS. Data were collected during in-home visits at ages 1 and 1.5 years of age, lab visits for ages 6, 7, and 8, and online surveys at age 29. At age 1, parents reported demographics (infant sex, occupation, parent educational attainment). At 1.5 years, parents reported infant happiness (positive and negative affect) and examiners measured intelligence. At ages 6, 7, and 8, children completed general intelligence exams. Participants reported their highest level of education at age 29. Parent-reported SES and infant sex at age 1 were included as covariates, given prior research linking both factors to educational attainment and SES to IQ (e.g., Krapohl & Plomin, 2016; Sirin, 2005). First, positive and negative affect were examined as direct predictors of the two primary outcomes variables: educational attainment and childhood IQ (a composite of childhood IQ scores). Then, childhood IQ was examined as a link between infant happiness and adult educational attainment (see Figure 1).

## Measures

**Demographic covariates.** Parents reported a range of demographic factors including their own educational attainment, occupation, and infant sex at age 1. Infant sex was coded 1 for females and 2 for males. Parent SES was calculated using the Hollingshead Four-Factor Index (Gottfried, 1985), which includes dimensions accounting for parent occupation, education, and marital status. The resulting composite SES scores ($M = 45.56$, $SD = 11.86$) represent factors commonly associated with educational attainment that indicates a wide range of middle-SES families (for more information, see Gottfried, 1985). Parent SES and infant sex were used as covariates.

**Infant happiness.** To measure affect at 1.5 years, items focused on general positive or negative affect frequency from a previously validated measure (Coffey et al., 2015) adopted from the Infant Characteristics Questionnaire (Bates, Freeland, & Lounsbury, 1979). Items were excluded if they focused on situational factors (e.g., transitions) and broader level temperament areas as these are less representative of affect frequency. Parents responded to two items for positive affect (e.g., "What kind of mood is your baby generally in?") and three items for negative affect (e.g., "How much does your baby cry and fuss in general?") on 7-point Likert scale corresponding to each item (e.g., 1 = *serious* to 7 = *very happy and cheerful* for positive affect item). Composites were created such that higher scores indicate more positive ($M = 4.99$, $SD = .93$) and negative ($M = 2.97$, $SD = .96$) affect. For full details of items used, response options, and validity evidence, see Coffey et al. (2015).

**Infant intelligence.** Infant intelligence was measured using the Mental Development Index of the Bayley Scales of Infant Development (Bayley, 1969). During testing, an examiner rated children's cognitive behaviors as pass or fail on 163 items (e.g., "Builds a tower of 6 cubes"). Interrater reliability exceeded .92 (Gottfried & Gottfried, 1984). Higher scores indicate higher intelligence. This well-established measure of infant intelligence has been linked to later intelligence and other relevant constructs (e.g., Guerin et al., 2003; Yu et al., 2018).

**Childhood intelligence.** As an objective proxy for cognitive resources, children completed a gold-standard measure of intelligence, the Wechsler Intelligence Scale for Children—Revised (WISC–R; Wechsler, 1974), at ages 6, 7, and 8. I followed a similar approach to prior IQ studies (e.g., Yu et al., 2018) and created a latent variable composite using full IQ scores from childhood. In a confirmatory factor analyses, all factors loaded onto a latent structure between .87 and .92. Means ranged from 114.45 to 116.40 with *SDs* from 12.57 to 14.10. For more on the validity and reliability of this measure, see Wechsler (1974).

**Adult academic success.** At age 29, participants reported their highest level of education in a single item (i.e., "Please check the highest level of schooling you have completed"). Options ranged from "high school not completed" to "graduate/professional school." Responses were used to calculate total years of education with higher scores indicating more education. At age 29, participants reported an average of 15.19 ($SD = 2.12$) years of education suggesting that most participants had at least some college.

## Statistical Analysis

Mplus 7.4 (Muthén & Muthén, 1998–2017) was used to test measurement and structural models. First, a measurement model including composites of all the study variables was used. Next, structural models were used to test all hypotheses. Means and standard deviations for all measured variables are displayed in Table 1. Covariance coverage was good ranging from .75 to 1.00. To reduce model complexity and to keep degrees of freedom reasonable, I used composite variables[1] for all predictor variables. Full information likelihood was used to model missing data by providing unbiased parameter estimates and standard errors in a single step (Graham, 2009). To minimize the negative impact of any nonnormality in the data, I used a conservative method, maximum likelihood estimation with robust standard errors (MLR).

[1] Models with positive and negative affect as latent variables showed similar fit and results so I present the more parsimonious model.

Table 1
*Basic Correlations, Means, and Standard Deviations (n = 130)*

| Variable | Mean | *SD* | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Sex | 1.47 | .49 | −.11 | −.01 | .00 | .10 | .03 | .01 | .11 | .08 |
| 2. Parent SES | 45.56 | 11.86 | | .10 | −.13 | .39*** | .42*** | .39*** | .51*** | .28*** |
| 3. Positive affect | 4.99 | .93 | | | −.45*** | .26** | .28** | .24** | .27*** | .11 |
| 4. Negative affect | 2.97 | .96 | | | | −.17 | −.27* | −.26** | −.21* | −.05 |
| 5. IQ (age 6) | 114.45 | 12.58 | | | | | .80*** | .79*** | .43*** | .46*** |
| 6. IQ (age 7) | 116.41 | 13.20 | | | | | | .83*** | .37*** | .43*** |
| 7. IQ (age 8) | 115.95 | 14.10 | | | | | | | .40*** | .42*** |
| 8. Educational attainment | 15.19 | 2.12 | | | | | | | | .29** |
| 9. Infant intelligence | 113.44 | 16.55 | | | | | | | | |

*Note*. Sex and parent socioeconomic status (SES) were reported at age 1, positive and negative affect were parent reported when infants were age 1.5, and educational attainment was self-reported at age 29. Infant intelligence was measured at age 1.5.
* $p < .05$. ** $p < .01$. *** $p \leq .001$.



## Results

### Measurement Model

A measurement model to test parameters and goodness-of-fit estimates ($n = 130$) demonstrated excellent model fit, comparative fit index (CFI) = 1.00, Tucker-Lewis index (TLI) = 1.00, root mean square error of approximation (RMSEA) < .001 (90% confidence interval (CI) [.00, .09]), $\chi^2(10) = 9.41$, $p = .494$. Table 1 contains all means and correlations. All correlations were in the expected direction. All measured variables and the latent variable exhibited discriminant validity (max $r = .51$) indicating that empirical underidentification was not a problem. The measurement model results suggest that a structural model using these constructs may depict developmental associations over time.

### Analytic Plan

In working toward the final mediation prediction model (see Figure 1), a multistep longitudinal SEM approach tested different parts of how positive and negative affect during infancy predicted adult educational attainment and childhood IQ. Standardized effects (β) are presented unless otherwise noted. In the first stage (c path), I examined infant positive (H1a) and negative (H1b) affect as unique predictors of adult educational attainment with parent SES and infant sex as covariates (because they are known predictors of educational attainment; e.g., Krapohl & Plomin, 2016; Sirin, 2005). Then, an alternative explanation model that added intelligence during infancy was tested. In the next stage (a path), I examined infant positive (H2a) and negative (H2b) affect as unique predictors of childhood IQ with parent SES and sex as covariates. Again, an alternative explanation model which added intelligence during infancy was tested. This approach added the ability to examine if positive affect predicted changes in childhood IQ. Given established links between IQ and educational attainment (b path), I moved directly to testing the full mediational model. I tested childhood IQ as a link between infant positive and negative affect and adult educational attainment (H3). Finally, I added infant intelligence to the last H3 model to determine if positive affect predicted childhood IQ and educational attainment beyond infant intelligence.

### Affect and Educational Attainment

To test the direct links between affect and educational attainment, I removed intelligence variables and added separate predictor pathways from positive affect, negative affect, SES, and sex during infancy to adult educational attainment (see Figure 2). Infant positive and negative affect were inversely correlated, $\beta = -.41$ (95% CI [−.661, −.290]), $p < .001$. As hypothesized, with positive affect, $\beta = .20$ (.012, .385), $p = .037$, and negative affect, $\beta = -.08$ (95% CI [−.256, .103]), $p = .416$, in the model, only positive affect predicted educational attainment after controlling for sex ($\beta = .16$ (95% CI [.010, .311]), $p = .041$) and SES ($\beta = .51$ (95% CI [.371, .648]), $p < .001$). Model fit ($n = 124$) was good, CFI = 1.00, TLI = 1.04, RMSEA < .001 (90% CI [.00, .11]), $\chi^2(4) = 2.36$, $p = .669$. No other modifications were suggested (in the Mplus fit indices) or made. This model accounted for 33% of the variance in adult educational attainment. Thus,

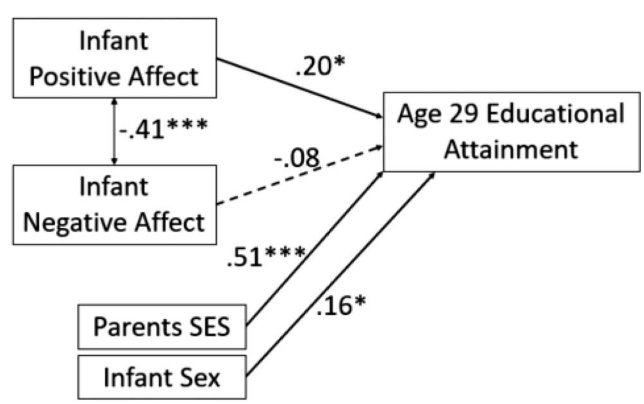


*Figure 2.* Positive and negative affect during infancy predicting adult education. Structural equation model ($n = 124$) standardized effects supported hypotheses that positive affect but not negative affect (age 1.5) would predict adult educational attainment (age 29) after accounting for sex and parent socioeconomic status (SES). Sex and parent SES were measured at age 1. Sex was coded as 1 for females and 2 for males. Dotted pathways are not significant. Model fit was good, comparative fit index = 1.00, Tucker-Lewis index = 1.04, root mean square error of approximation < .001 (90% CI [.00, .11]), $\chi^2(4) = 2.36$, $p = .669$. * $p \leq .05$. ** $p < .01$. *** $p \leq .001$.

higher infant positive affect, but not negative affect, predicted higher adult educational attainment even when accounting for parent SES and sex.

As a follow up, negative affect was removed to create a more parsimonious model. Infant positive affect, β = .21 (95% CI [.050, .368]), $p$ = .010, predicted educational attainment after controlling for sex (β = .15 (95% CI [.001, .300]), $p$ = .048), and SES (β = .53 (95% CI [.404, .660]), $p$ < .001). This model ($n$ = 101) was identified[2] and did not provide any fit indices. By fixing the relationship between sex and parent SES to zero, all effects and significance levels were similar and model fit ($n$ = 123) was good, CFI = 1.00, TLI = 1.01, RMSEA < .001 (90% CI [.00, .15]), $\chi^2(3)$ = 2.75, $p$ = .436. After accounting for sex and parent SES, the unstandardized effect size of having 1-point higher happiness was associated with 0.49 (95% CI [.109, .864]) additional years of education ($SE$ = 0.19, $p$ = .012). This model accounted for 37% of the variance in adult educational attainment. As hypothesized, higher positive affect (H1a) but not lower negative affect (H1b) predicted adult educational attainment even when accounting for sex and parent SES.

**Alternate explanation.** Given that intelligence is linked to educational attainment (Ritchie & Tucker-Drob, 2018), an alternate explanation could be that positive affect is an indicator of intelligence during infancy and would have no predictive value beyond intelligence. To test this explanation, I added age 1.5 intelligence to the previous model as a predictor of adult educational attainment. Given that IQ and SES are related (e.g., Sauce & Matzel, 2018), intelligence during infancy was correlated with SES. No other modifications were suggested (in the Mplus fit indices) or made. As expected, higher infant positive affect directly predicted higher educational attainment (H1a), β = .20 (95% CI [.032, .359]), $p$ = .019, even after including intelligence during infancy, β = .13 (95% CI [−.036, .300]), $p$ = .123, sex, β = .15 (95% CI [.000, .299]), $p$ = .050, and parent SES, β = .51 (95% CI [.376, .646]), $p$ < .001. Intelligence during infancy was correlated with SES, β = .29 (95% CI [.136, .452]), $p$ < .001. Notably, intelligence during infancy was not correlated with positive affect and did not predict adult educational attainment beyond the other factors. The model (see Figure 3) fit was ($n$ = 123) was good, CFI = .99, TLI = .99, RMSEA = .03 (90% CI [.00, .144]), $\chi^2(4)$ = 4.53, $p$ = .339. Overall, this model accounted for 38% of the variance in adult educational attainment. As further exploration, a correlation between intelligence and positive affect (β = .11 (95% CI [−.061, .280]), $p$ = .208) during infancy was added to this model but it was not significant nor did it improve model fit. Given that a relationship between positive affect and intelligence was not expected or supported, this model was not retained. These alternative models indicate infant positive affect and intelligence are distinguishable and unrelated. This additional testing adds support for H1a over the alternative explanation because intelligence during infancy did not predict adult educational attainment beyond the other factors but positive affect during infancy did predict adult educational attainment.

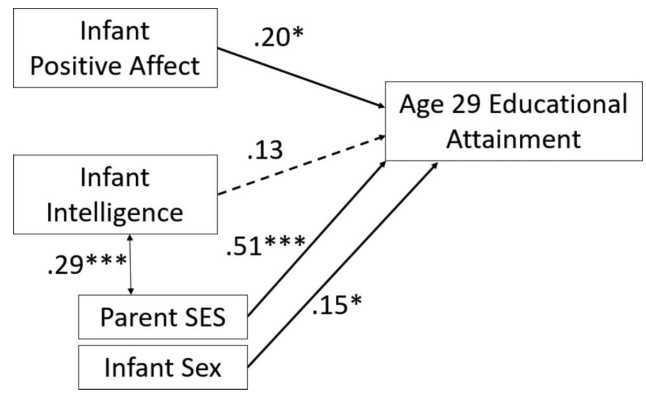


*Figure 3.* Positive affect and intelligence during infancy as predictors of adult education. Structural equation model ($n$ = 123) standardized effects supported hypothesis that positive affect (age 1.5) would predict adult educational attainment (age 29) after including intelligence (age 1.5), sex, and parent socioeconomic status (SES). Sex and parent SES were measured at age 1. Sex coded as 1 for females and 2 for males. Dotted pathways are not significant. Model fit was good, comparative fit index = .99, Tucker-Lewis index = .99, root mean square error of approximation = .03 (90% CI [.00, .144]), $\chi^2(4)$ = 4.53, $p$ = .339. $^*$ $p \leq .05$. $^{**}$ $p < .01$. $^{***}$ $p \leq .001$.

## Childhood IQ Models

**Affect and IQ.** To test the links between affect and childhood IQ, I excluded educational attainment and added separate predictor pathways were added from infant positive affect, negative affect, sex, and SES to childhood IQ. Although sex was not expected to be related to infant affect or childhood IQ, it was included for consistency. As predicted, with positive affect, β = .20 (95% CI [.009, .392]), $p$ = .040, and negative affect, β = −.12 (95% CI [−.305, .057]), $p$ = .180, in the model, only positive affect predicted childhood IQ after controlling for sex (β = .09 (95% CI [−.082, .261]), $p$ = .307) and parent SES (β = .43 (95% CI [.255, .602]), $p$ < .001). Positive and negative affect were inversely related, β = −.45 (95% CI [−.611, −.290]), $p$ < .001. Model fit ($n$ = 123) was good, CFI = 1.00, TLI = 1.01, RMSEA < .001 (90% CI [.00, .08]), $\chi^2(12)$ = 9.80, $p$ = .634 (see Figure 4). No other modifications were suggested (in the Mplus fit indices) or made. The model accounted for 26% of the variance in childhood IQ. As hypothesized, higher infant positive affect, but not lower negative affect, predicted higher IQ even when accounting for sex and SES.

As a follow up, negative affect and sex were removed to create a more parsimonious model. Infant positive affect, β = .24 (95% CI [.070, .414]), $p$ = .006, predicted childhood IQ after controlling for SES (β = .45 (95% CI [.283, .612]), $p$ < .001). In this model, fit ($n$ = 105) was good, CFI = 1.00, TLI = 1.02, RMSEA < .001 (90% CI [.00, .07]), $\chi^2(4)$ = 1.22, $p$ = .875. No other modifications were suggested (in the Mplus fit indices) or made. After accounting for parent SES, the unstandardized effect size of having 1-point higher happiness was 2.82 (95% CI [.768, 4.871]) more childhood IQ points ($SE$ = 1.05, $p$ = .007). This model accounted for 29% of the variance in childhood IQ. As hypothesized, higher positive affect (H2a) but not lower negative affect (H2b) predicted childhood IQ.

[2] By fixing the relationship between sex and parent SES to zero, all effects and significance levels were similar and model fit ($n$ = 123) was good, CFI = 1.00, TLI = 1.01, RMSEA < .001 (90% CI [.00, .15]), $\chi^2(3)$ = 2.75, $p$ = .436.

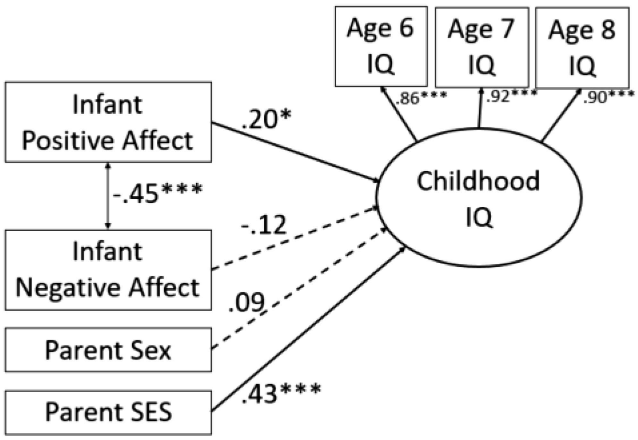


*Figure 4.* Positive and negative affect during infancy as predictors of childhood IQ. Structural equation model ($n$ = 123) standardized effects supported hypotheses that positive affect but not negative affect (age 1.5) would predict childhood IQ (age 29) after controlling for sex and parent socioeconomic status (SES). Sex and parent SES was measured at age 1. Dotted pathways are not significant. Model fit was good, comparative fit index = 1.00, Tucker-Lewis index = 1.01, root mean square error of approximation < .001 (90% CI [.00, .08]), $\chi^2(12) = 9.80$, $p$ = .633. $^{*}$ $p \leq .05$. $^{**}$ $p < .01$. $^{***}$ $p \leq .001$.

**Alternative explanation.** In the previous model, temporal precedence between positive affect and IQ was unclear. I added age 1.5 intelligence to the previous model and correlated it with SES to see if positive affect during infancy still predicted childhood IQ. Positive affect, β = .21 (95% CI [.044, .376]), $p$ = .013, and intelligence during infancy, β = .36 (95% CI [.185, .536]), $p < .001$, predicted childhood IQ after accounting for SES (β = .37 (95% CI [.189, .548]), $p < .001$). Intelligence during infancy and SES were correlated (β = .28 (95% CI [.121, .444]), $p$ = .001). In this model, fit ($n$ = 123) was good, CFI = 1.00, TLI = 1.02, RMSEA < .001 (90% CI [.00, .08]), $\chi^2(8) = 5.19$, $p$ = .737. No other modifications were suggested (in the Mplus fit indices) or made. This model accounted for 39% of the variance in childhood IQ. Thus, positive affect predicted increases in childhood IQ.

## Affect as a Predictor of Childhood IQ and Adult Educational Attainment

To test if childhood IQ partially explained the relationship between infant affect and adult educational attainment (H3), I added directional pathways from the prediction model to the measurement model (see Figure 1). Specifically, separate predictor pathways were added from infant positive affect (H2a) and negative affect (H2b) to the childhood IQ latent variable and from this IQ variable to adult educational attainment. A direct pathway was added from infant positive affect to adult educational attainment. Based on prior models and the prediction model, parent SES was included as a covariate for both childhood IQ and adult educational attainment. Sex was included as a covariate for adult educational attainment. The model pathways were consistent with all hypotheses and prior models even after accounting for SES (β = .43 (95% CI [.279, .576]), $p < .001$) to educational attainment, sex (β = .15 (95% CI [.002, .299]), $p$ = .047) to educational attainment, and SES to childhood IQ (β = .42 (95% CI [.246, .593]), $p < .001$). Positive affect was a significant predictor of childhood IQ, β = .20 (95% CI [.004, .396]), $p$ = .046, and childhood IQ predicted adult educational attainment, β = .21 (95% CI [.035, .384]), $p$ = .019. The direct path from positive affect to educational attainment was significant, β = .18 (95% CI [.004, .347]), $p$ = .045. The indirect path from positive affect to educational attainment via IQ was marginal, β = .04 (95% CI [−.006, .089]), $p$ = .084. Notably, with positive affect in the model, the negative affect to IQ path (H2b) was not significant (β = −.13 (95% CI [−.311, .051]), $p$ = .159). Positive and negative affect were inversely correlated, $r$ = −.45 (95% CI [−.611, −.291]), $p <$ .001. Model fit ($n$ = 125) was good, CFI = 1.00, TLI = 1.01, RMSEA < .001 (90% CI [.00, .07]), $\chi^2(16) = 13.22$, $p$ = .656. No other modifications were suggested (in the Mplus fit indices) or made. This model accounted for 26% of the variance in childhood IQ and 36% of the variance in educational attainment. Again, all predictions were supported as positive affect (H1a) significantly predicted adult educational attainment via childhood IQ (H3) but negative affect was not associated with either outcome variable.

Next, negative affect was removed to present a more parsimonious model (See Figure 5). No other modifications were suggested (in the Mplus fit indices) or made. As expected, higher positive affect directly predicted higher childhood IQ (H2a), β = .25 (95% CI [.079, .426]), $p$ = .004, and directly predicted adult educational attainment, β = .17 (95% CI [.004, .344]), $p$ = .045. The indirect path from infant positive affect to adult educational attainment via childhood IQ was also significant, β = .05 (95% CI [.002, .096]), $p$ = .043 (supporting H1a), even after accounting for the relationship between SES and childhood IQ, β = .42 (95% CI [.251, .595]), $p < .001$. Childhood IQ (β = .21 (95% CI [.035, .383]), $p$ = .018) significantly predicted adult educational attainment after including sex (β = .15 (95% CI [.003, .295]), $p$ = .046) and parent SES (β = .42 (95% CI [.275, .570]), $p < .001$). The

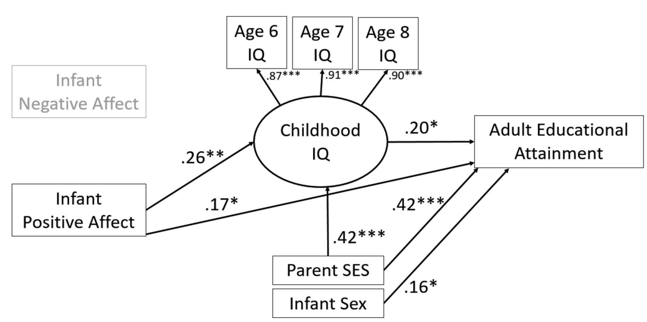


*Figure 5.* Positive affect during infancy predicted educational attainment via childhood IQ. Structural equation model ($n$ = 126) standardized effects supported hypotheses that infant positive affect (age 1.5 years) would predict age 29 educational attainment via childhood IQ scores after accounting for sex and parent socioeconomic status (SES). After controlling for positive affect, negative affect was removed from the model (faded out above because it was initially modeled) because it was not significantly related to outcome variables. Sex and parent SES were measured at age 1. Sex coded as 1 for females and 2 for males. All modeled pathways are significant. Model fit was good fit was good, comparative fit index = 1.00, Tucker-Lewis index = 1.01, root mean square error of approximation < .001 (90% CI [.00, .08]), $\chi^2(12) = 10.15$, $p$ = .603. $^{*}$ $p \leq .05$. $^{**}$ $p < .01$. $^{***}$ $p \leq .001$.

model (see Figure 5) fit was ($n$ = 126) was good, CFI = 1.00, TLI = 1.01, RMSEA < .001 (90% CI [.00, .08]), $\chi^2(12) = 10.15$, $p = .603$. No other modifications were suggested (in the Mplus fit indices) or made. Overall, this model accounted for 24% of the variance in childhood IQ and 37% in adult educational attainment. Thus, all hypotheses were supported.

**Alternate explanation.** As a more rigorous test and to examine temporal precedence, age 1.5 intelligence was added to the model as a predictor of childhood IQ and correlated with SES. No other modifications were suggested (in the Mplus fit indices) or made. Infant intelligence was associated with infant SES, $\beta = .29$ (95% CI [.129, .447]), $p = .001$. As expected, higher infant positive affect directly predicted higher childhood IQ (H2a), $\beta = .21$ (95% CI [.041, .374]), $p = .014$, and marginally predicted adult educational attainment (H1a), $\beta = .16$ (95% CI [−.005, .325]), $p = .057$, even after controlling for the relationships between childhood IQ and intelligence during infancy, $\beta = .36$ (95% CI [.183, .536]), $p < .001$, and SES, $\beta = .37$ (95% CI [.187, .545]), $p < .001$. The indirect path from infant positive affect to adult educational attainment via childhood IQ was marginal, $\beta = .04$ (95% CI [−.002, .084]), $p = .059$. Childhood IQ significantly predicted adult educational attainment ($\beta = .20$ (95% CI [.029, .369]), $p = .022$) after controlling for the relationships between educational attainment and sex ($\beta = .15$ (95% CI [.003, .298]), $p = .046$) and parent SES ($\beta = .46$ (95% CI [.314, .604]), $p < .001$). Infant intelligence marginally predicated adult education via childhood IQ, $\beta = .07$ (95% CI [−.001, .144]), $p = .053$. The model (see Figure 6) fit was ($n$ = 123) was good, CFI = 1.00, TLI = 1.02, RMSEA < .001 (90% CI [.00, .07]), $\chi^2(16) = 12.68$, $p = .696$. Overall, this model accounted for a significant amount of variance in childhood IQ, 38%, and adult educational attainment, 40%. This alternative model further indicates infant positive affect and intelligence are distinguishable. Further supporting H3, after adjusting for infant intelligence, positive affect predicted changes in intelligence and adult education.

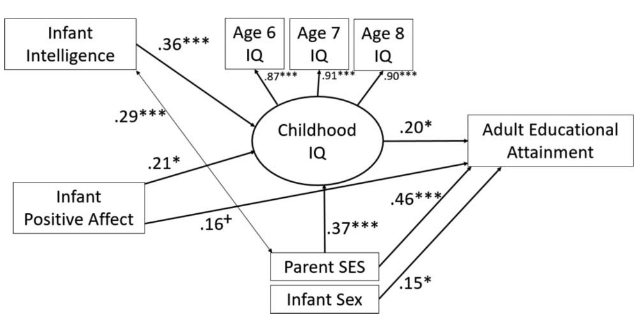


*Figure 6.* Positive affect predicted changes in intelligence and adult education attainment via childhood IQ. Structural equation model ($n$ = 123) standardized effects supported hypotheses that infant positive affect (age 1.5 years) would predict age 29 educational attainment via childhood IQ scores after accounting for for intelligence (age 1.5), sex, and parent socioeconomic status (SES). Sex and parent SES were measured at age 1. Sex coded as 1 for females and 2 for males. Model fit was good, comparative fit index = 1.00, Tucker-Lewis index = 1.02, root mean square error of approximation < .001 (90% CI [.00, .07]), $\chi^2(16) = 12.68$, $p = .696$. $^{\dagger}$ $p < .06$. $^{*}$ $p \leq .05$. $^{**}$ $p < .01$; $^{***}$ $p \leq .001$.

## Discussion

This is the first study to offer evidence that happiness during infancy predicts childhood cognitive abilities and adult success. In this study, higher positive affect during infancy (age 1.5) predicted higher childhood IQ (ages 6–8) and adult educational attainment (age 29), even after accounting for sex, parent SES (included parent occupations and education levels), and intelligence during infancy. In this low-risk sample, negative affect during infancy did not predict IQ or educational attainment beyond positive affect. These findings are particularly important because happiness was measured before formal education begins, thus reducing directionality concerns and confounds from formal education. Further, positive affect predicted childhood IQ beyond intelligence and negative affect during infancy. In other words, happiness during infancy does not appear to represent general intelligence (during infancy), and it preceded measures of success. Further, education attainment and IQ were objectively measured using gold standard measures and results held even after accounting for parent SES and participant sex. This study adds to the evidence highlighting that early life positive and negative affect and other socioemotional factors are uniquely associated with cognitive abilities and academic success (e.g., Coffey et al., 2016; Dindo et al., 2017; Duyme et al., 1999; Moed et al., 2017). Given that happiness, IQ, and education are all associated with long-term benefits such as better health, wealth, and success (e.g., Lynn, 2010; Lyubomirsky, King, et al., 2005; Vaillant & Mukamal, 2001), these results offer strong evidence about the potential of positive affect during infancy to provide a foundation for long-term learning, education, and success.

### Infant Happiness Cascades Into Cognitive Abilities and Academic Success

By linking infant happiness to later IQ and academic success, this study is the first to provide empirical evidence about how early life happiness may precede adult success. Notably, the small to moderate effect of positive affect predicting childhood IQ was comparable in size to some of the largest known nongenetic predictors of IQ, such as educational experiences (e.g., Ritchie & Tucker-Drob, 2018). In line with Lyubomirsky and colleagues' (2005) model that happiness predicts success, these results demonstrate that happiness predicting adult success can start as early as 1.5 years old. Similarly, these findings support the broaden-and-build theory (Fredrickson, 2013) by offering indirect evidence that infant positive affect is associated with increases in intellectual resources (i.e., higher IQ scores) and greater educational attainment. Further, childhood IQ only partially explains the link between positive affect and adult education, suggesting that other resources might also contribute to the educational benefits of positive affect during infancy. Given that positive affect is connected to many other benefits (e.g., social skills, improved health; Coffey, 2018; Fredrickson, 2013), future research may wish to consider whether these beneficial outcomes are also linked to affect during infancy and later in childhood.

In the current study, positive affect predicted IQ and success after accounting for negative affect (whereas negative affect did not predict either). These findings align with a large literature highlighting that positive and negative affect are distinctively important to development, success, and well-being (Abe & Izard, 1999; Coffey, 2018; Coffey et al., 2015; Davis & Suveg, 2014; Diener & Emmons, 1984). Even though negative affect was unrelated to IQ and educational attainment, it is still important to consider the role and frequency of negative affect. Negative affect can be adaptive at times (Abe & Izard, 1999; Coffey, 2018), but ongoing adversity and high levels of negative affect are linked to many suboptimal and maladaptive outcomes like lower cognitive abilities and academic performance (Denham, 1986; Duyme et al., 1999; Katz, Sprang, & Cooke, 2012; Owens, Stevenson, Hadwin, & Norgate, 2014). In the present study, the community sample included a range of parent occupations (from working class to professional) and SES (which included parent education levels) but was relatively low risk as indicated by the low levels of negative affect. As such, in samples demonstrating high levels of adversity, negative affect might be associated with cognitive limitations and reduced success after accounting for positive affect.

As positive and negative affective frequency provides unique information about future well-being (e.g., Abe & Izard, 1999; Coffey et al., 2015; Holder & Coleman, 2008), there are additional factors worth considering about sources of happiness during infancy. Notably, developmental research focuses heavily on negative experiences or negative affect, so a more balanced focus that includes positive affect is needed. This is especially important, given the benefits of positive affect demonstrated in the current study along with other findings that positive affect is ubiquitous (e.g., Diener & Emmons, 1984; Izard et al., 1980) and that positive affect should offer similar benefits at later developmental stages.

As noted, affect and happiness are influenced by biological (e.g., genetics, temperament) and environmental factors at all ages (e.g., Abe & Izard, 1999; Coffey, 2018; Izard et al., 1980; Gray & Watson, 2001; Holder & Coleman, 2008; Lyubomirsky, Sheldon, et al., 2005), so both need to be considered when thinking about sources of infant happiness. Importantly, environmental factors during infancy can certainly influence affect as infants express a wide range of emotions and frequency (Abe & Izard, 1999; Izard et al., 1980). By 1.5 years of age, affective frequency is associated with factors like caregiver-child attachment (Ainsworth, 1979) or even playful interactions (Izard et al., 1980). Thus, simple age-appropriate activities (e.g., reading with children, playtime, or recess), caregiving strategies, or interventions during early development that directly or indirectly cultivate frequent joy, kindness, gratitude, or interest may have long-lasting implications for academic success and well-being. Parents, caregivers, and educators are likely to embrace ideas that promote positive experiences rather than just preventing negative experiences.

## Limitations and Future Directions

Although these findings span from infancy to adulthood, limitations of this work and future directions are worth considering. Most of the sample was Caucasian with two-parent homes (at the beginning of the study). Notably, affect in infancy was unrelated to SES and intelligence during infancy, but this sample had above average IQs and achieved somewhat higher levels of education and lower variability than other community American samples (e.g., Assari & Mistry, 2018; Owens, 2016). Further, education and parenting styles tend to vary across cultures in ways that might shape affective experiences. Given these factors, these findings need to be replicated in other populations. Future studies using experimental designs or more frequent measurement of all variables and a wider range of affect would be informative for understanding causal links and changes over time. Given the links between affect and success found in this study and in other studies at various ages (e.g., Coffey et al., 2016; Lyubomirsky, King, et al., 2005; Moed et al., 2017), more research is needed to fully understand what predicts and grows happiness during infancy and childhood. For example, cultivating happiness in adults and kindness in children has been effective in producing psychological and physiological benefits (Flook et al., 2015; Kok et al., 2013; Nelson et al., 2016; Nelson-Coffey et al., 2017). Similar age-appropriate interventions for children and their caregivers may yield long-lasting benefits and contribute greater understanding regarding causal pathways to future success. These studies could also consider additional ways that positive affect is linked to educational attainment (e.g., social skills) beyond childhood IQ or what connects positive affect during infancy to later IQ.

## Conclusion

Although parents and others might focus on success as a path to happiness, this study finds a different pattern: Positive affect during infancy (prior to any formal education) predicts later cognitive abilities and adult academic success at levels comparable to other external factors like educational training. Given that happiness, cognitive abilities, and educational success are linked to other adult outcomes such as better health, living longer, higher income, and greater subjective well-being, early life positive affect appears to be a component of the foundation for later success and well-being. In summary, positive affect during infancy may generate cascades of success and associated well-being that offer benefits that extend for decades. As such, parents, educators, and policymakers may want to place a higher value on early affective experiences when considering educational success.

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Received December 13, 2018
Revision received May 13, 2019
Accepted May 14, 2019 ■