Are Awe-Prone People More Curious? The Relationship Between Trait Awe, Curiosity, and Academic outcomes

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Abstract

**Objective:** Guided by a functional account of awe, we aimed to test the hypothesis that people who often feel awe are also more curious (Studies 1 and 2), and that this relationship in turn related to academic outcomes (Study 3).

**Method:** In Study 1 \((n = 1,005)\), we used a self-report approach to test the relationship between trait awe and curiosity. In Study 2 \((n =100)\), we used a peer-report approach to test if participants’ trait awe related to how curious they were rated by their friends. In Study 3, in a sample of 447 high school adolescents we tested of trait awe predicted academic outcomes via curiosity.

**Results:** We found that trait awe was positively related to people’s self-rated curiosity (Study 1) and how curious they were rated by their friends (Study 2). In Study 3, we found that trait awe predicted academic outcomes via curiosity.

**Conclusions:** We conclude that among trait positive emotions, awe is uniquely related to curiosity, and this link in turn predicts academic outcomes. This work further characterizes awe as an epistemic emotion and suggests that activities that inspire awe may improve academic outcomes.

(Words: 188)

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One cannot help but be in awe when he contemplates the mysteries of eternity, of life, of the marvelous structure of reality. It is enough if one tries merely to comprehend a little of this mystery every day. Never lose a holy curiosity.


An examination of people who have pushed the boundaries of human knowledge suggests that awe, an emotion felt in the presence of vast stimuli that transcend understanding (Keltner & Haidt, 2003), moves people to be curious about the world and pursue such curiosity in acts of exploration and innovation. For example, the awe that Marie Curie felt toward the radioactive subjects of her research, which glowed “like faint, fairy light,” fueled the curiosity that led to the identification of new elements and a scientific career distinguished by two Nobel Prizes (Goldsmith, 2005, p. 96). For John Muir, it was profound feelings of awe elicited by nature that propelled him across the peaks and valleys of the Sierra Nevada and to scientific discovery (Muir, 1894). The core themes in these life narratives, captured by Einstein’s quote above, suggest that awe-prone people are highly curious and motivated to learn about the world in which we live. However, no empirical work has systematically tested the relationship between awe and curiosity at the trait level, and whether this relationship is unique among positive emotions. In the present investigation, we aimed to provide the first evidence for the unique relationship between trait awe and curiosity. Moreover, we tested the importance of this relationship by examining the how trait awe and curiosity relate to academic outcomes.

What Predicts Trait Curiosity?
Much of the scientific literature on the subject of curiosity, described generally as the desire to learn and acquire new knowledge (Kang et al., 2009), has focused on the assessment of subtypes of curiosity that are elicited by different classes of stimuli, such as perceptual features (Collins, Litman, & Spielberger, 2004), social situations (Renner, 2006), epistemic components (Litman & Spielberger, 2003), and information deprivation (Litman & Silvia, 2006; Litman & Jimerson, 2004). Relatively less work has focused on what factors predict curiosity. One such factor is Openness to Experience, a personality trait that describes “the breadth, depth, originality, and complexity of an individual’s mental and experiential life” (John & Srivastava, 1999, p. 121). Openness has been consistently linked to curiosity measures with correlations ranging between $r = .19$ to $r = .57$ (Kashdan & Steger, 2007; Kashdan et al., 2009; Kashdan, Rose, & Fincham, 2004; Mussel, 2010).

Positive affect has also been shown to relate to curiosity. For example, studies guided by the Broaden and Build theory (Fredrickson, 1998, 2013) have found that state-like occurrences of positive emotions (e.g., serenity, joy, amusement), relative to negative emotions (e.g., anger, sadness) and neutral states, promote behaviors related to curiosity such as wider range of thoughts and behaviors (Fredrickson & Branigan, 2005; Johnson, Waugh, & Fredrickson, 2010; Wadlinger & Isaacowitz, 2006). Indeed, the trait tendency to experience positively valenced activation, as measured by the Positive and Negative Activation Schedule (PANAS; Watson, Clark, & Tellegen, 1988), has also been shown to relate to trait measures of curiosity such as the Curiosity and Exploration Inventory (CEI; Gallagher & Lopez, 2007; Kashdan et al., 2009, 2004; Neff, Rude, & Kirkpatrick, 2007) and the State Trait Curiosity Inventory (STCI; Kashdan, 2002; Kashdan & Roberts, 2004a, 2004b; Spielberger, Peters, & Frain, 1976). Further support for the link between curiosity and positive emotions is provided by work that examined the zero-order
correlations between trait-level discrete positive emotions and the Values in Action Inventory of Strengths (VIA; Peterson & Seligman, 2004), which includes curiosity (Güsewell & Ruch, 2012). In this study, the trait-level awe and five other positive emotions—amusement, contentment, compassion, joy, and pride—were found to be positively related to curiosity (Güsewell & Ruch, 2012), although systematic analyses parsing the unique effects of awe or other distinct positive emotions on curiosity were not conducted. In sum, empirical evidence suggests that both Openness to Experience and positive affect, generally construed, are directly related to curiosity. Any attempt, therefore, to document the relationship between trait awe and curiosity must account for the Openness to Experience and other positive emotions to ascertain whether the expected influences of awe are unique or part of a more general association between positive affect and curiosity.

Awe and Curiosity

Recently, psychological scientists have begun to document the state and trait level outcomes of awe, including an increased sense of time (Rudd, Vohs, & Aaker, 2012), humility (Stellar et al., 2017), reduced self-awareness (Bai et al., 2017), prosociality (Piff, Dietze, Feinberg, Stancato, & Keltner, 2015), enhanced scientific reasoning (Gottlieb, Keltner, & Lombrozo, 2018; Valdesolo, Shtulman, & Baron, 2016), and engagement in explanatory frameworks (Valdesolo & Graham, 2014; Valdesolo, Park, & Gottlieb, 2016). A common theme in these findings is that awe directs attention away from the self, outwards to one’s physical and social environment. These findings together with analysis of the appraisals that lead to awe support our claim that above and beyond other positive emotions, awe is uniquely related to curiosity.
Awe is produced by a distinct set of appraisals related to the incongruity between one’s knowledge and information in the external world. Specifically, the experience of awe is produced by two central appraisals: perceptual vastness, and need for accommodation (Keltner & Haidt, 2003). Vastness signifies a departure from one’s typical frame of reference and can be instantiated by physical, temporal, and social dimensions. Empirical work has indeed demonstrated that experiences of vastness such as sitting beneath a replica *Tyrannosaurus Rex* skeleton (Shiota, Keltner, & Mossman, 2007), standing in a grove of tall trees (Piff et al., 2015), or taking in the view from the top of a tall tower (Stellar et al., 2017) reliably elicit awe. Accommodation, the other central appraisal that leads to awe, is necessary when new information is not accounted for by existing mental schema (Piaget, 1970). That awe-eliciting stimuli need to be accommodated into mental schema is also supported by previous work. For example, when describing experiences of awe, people often refer to stimuli that transcend existing categories, actions of individuals that violate expectations about what humans are capable of, and express the need to understand, to inquire, to refine their knowledge about the world (Cohen, Gruber, & Keltner, 2010; Shiota et al., 2007). In short, people feel awe when they experience something perceptually vast that they cannot fully comprehend in the moment.

We argue that these appraisals make salient the incongruency between one’s existing knowledge and information in the environment, produce awe, and motivate curiosity, the acquisition of knowledge, and exploration (Keltner & Haidt, 2003). This functional analysis of awe converges with previous work suggesting that curiosity is triggered by information that makes the individual aware of gaps in existing knowledge structures (Kashdan, Sherman, Yarbro, & Funder, 2013; Kashdan & Steger, 2007; Kashdan, 2004; Kashdan et al., 2009; Loewenstein, 1994; Silvia & Kashdan, 2009). Not only do awe-eliciting stimuli represent a gap
in existing knowledge structures by nature of their need to be accommodated, but their vast nature makes them especially salient due to their departure from one’s typical frame of reference. When faced with such vast gaps in knowledge that awe-eliciting stimuli represent, one action tendency is to seek to close the gap by curiously gathering more information from the environment (Loewenstein, 1994). Following from this conceptual approach, we propose that a primary function of awe, unique among positive emotions, is to produce curiosity.

Research has linked awe with epistemic processes related to curiosity. For example, experimental work at the state level has shown that brief experiences of awe, compared to other positive emotions, increases systematic information processing and reduces reliance on heuristics, making people more likely to reject weak persuasive arguments (Griskevicius, Shiota, & Neufeld, 2010) and less likely to remember false details when remembering a story (Danvers & Shiota, 2016). Other work has shown that state awe leads to greater engagement in explanatory frameworks such as religion and science (Valdesolo & Graham, 2014; Valdesolo, Park, et al., 2016). Such work has led to recent theorizing that awe fosters scientific learning (Valdesolo, Shtulman, et al., 2016), which is supported by trait-level evidence showing that awe is positively related to basic understanding of scientific processes (Gottlieb et al., 2018). Taken together, this body of work suggests that awe promotes several distinct epistemic behaviors including systematic information processing, explanation, and scientific understanding. While at face value these behaviors seem quite different—or even antithetical in the case of religious and scientific thinking—they are all related to information seeking and how people learn about their physical and social world. Our claim that awe promotes curiosity, therefore, provides a framework that both unites the extant literature and motivates the present work.

**Current Investigation**
In the current work, we aimed to demonstrate a unique relationship between awe and curiosity and show that this link in turn is associated with academic outcomes. In pursuit of this aim, we took a trait-level approach that examined people’s general tendency to feel curiosity and different positive emotions. Affective traits have been conceptualized as “stable predispositions towards certain kinds of responding” (Rosenberg, 1998, p. 249). Given that state-level awe has been shown to promote behaviors related to curiosity (Danvers & Shiota, 2016; Gottlieb et al., 2018; Griskevicius et al., 2010; Valdesolo & Graham, 2014; Valdesolo, Park, et al., 2016; Valdesolo, Shtulman, et al., 2016), we argue that people who are disposed to feel awe more frequently and intensely would also be higher in trait curiosity. This is consistent with arguments suggesting that state and trait emotion have similar influences upon cognitive process (e.g., Lerner & Keltner, 2000, 2001; Oveis, Horberg, & Keltner, 2010; Rosenberg, 1998).

Based on this thinking we tested two primary hypotheses. First, we expected that even when controlling for personality factors known to be related to curiosity such as Openness to Experience and trait positive activation, as well as the other distinct trait positive emotions, awe would be related to self-rated (Studies 1 and 3) and peer-rated (Study 2) curiosity. Having demonstrated this unique relationship, we then tested its association with academic outcomes. We predicted that trait awe would indirectly predict several academic outcomes via curiosity (Study 3).

**Study 1: Trait awe and curiosity**

The purpose of Study 1 was to establish the unique relationship between awe and curiosity at the trait level. While initial work done by researchers using a German sample showed a zero-order relationship between trait awe and curiosity measured by the VIA (Güsewell & Ruch, 2012), they did not control for measures known to relate to both awe and
curiosity such as Openness to Experience (Danvers & Shiota, 2016; Kashdan et al., 2009, 2004; Shiota, Keltner, & John, 2006) and trait positive activation (Gallagher & Lopez, 2007; Mussel, 2010). This leaves open the possibility that Openness to Experience, for example, fully explains the relationship between awe and curiosity. We thus tested our hypothesis that awe would be uniquely related to curiosity by conducting a series of increasingly stringent models that controlled for Openness to Experience, trait positive activation, and six other discrete trait positive emotions: amusement, compassion, contentment, joy, love, and pride (e.g., Gottlieb et al., 2018).

Method

Participants and Procedure. Data from 1,005 people in the US from six separate samples were pooled, which represented both undergraduate students and people recruited using the Mechanical Turk (mTurk) platform, thus yielding samples that are relatively diverse with regards to age, race, and socioeconomic status (Buhrmester, Kwang, & Gosling, 2011). In all samples, people first completed demographic and trait measures via online survey software before participating in an unrelated study. Demographic characteristics of each individual sample as well as the combined sample are displayed in Table 1.

Measures. Descriptive statistics for Study 1 measures by sample are displayed in Table 2.

Curiosity and Exploration Inventory (CEI-II). There are many ways to measure subtypes of curiosity (Collins et al., 2004; Litman & Silvia, 2006; Litman & Jimerson, 2004; Litman & Spielberger, 2003; Renner, 2006). As this is the first attempt to systematically test the unique association between trait awe and curiosity when controlling for other positive emotions, we decided to use a broad conceptualization of curiosity that captures the external search for new
knowledge and understanding. Thus, we selected the CEI-II, a widely used measure of curiosity that operationalizes trait curiosity as the tendency to seek out new information and embrace the complexities of life (Kashdan et al., 2009). Participants rated how much each of ten items accurately reflected their general feelings and behavior. While the authors of the CEI-II presented evidence that it captures two different dimensions of curiosity, stretching and embracing (Kashdan et al., 2009), these dimensions are highly related and thus we take an approach commonly used in the literature and form a composite of all ten items (e.g., Kaczmarek et al., 2013; Kashdan, DeWall, et al., 2013; Kashdan, Afram, Brown, Birnbeck, & Drvoshanov, 2011). Two sample items are: *I actively seek as much information as I can in new situations* and *Everywhere I go, I am out looking for new things or experiences.* In the current sample, CEI-II scores were found to be reliable with an alpha estimate of .93. CEI-II scores were also found to be structurally valid with the result of a 1-factor exploratory factor analysis (principal axis factoring) revealing communalities (.40–.72) and factor loadings (.63–.85) within the acceptable range (Costello & Osborne, 2005).

**Dispositional Positive Emotion Scale (DPES).** The DPES consists of 38 items that measure people’s trait-level disposition to experience seven discrete positive emotions: awe, amusement, compassion, contentment, joy, love, and pride (Shiota et al., 2006). These seven discrete emotion scales have been shown to be robust and valid (Dixon, Anderson, & Keltner, 2018). Participants were instructed to respond on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*) based on how well each item describes their own tendencies. Sample items for each scale are: *I feel wonder almost every day, I see beauty all around me, and I often feel awe* (awe); *I find humor in almost everything* (amusement); *I often notice people who need help* (compassion); *I am generally a contented person* (contentment); *I am an intensely cheerful
person (joy); *I develop strong feelings of closeness to people easily* (love); and *I am proud of myself and my accomplishments* (pride). In the pooled data, all seven positive emotion scales were found to be reliable with all alpha estimates being > .7 (see Table 3). In addition, the scales were found to be structurally valid with a series of exploratory factor analyses revealing acceptable communality ranges (awe: .13–.64; amusement: .27–.57; compassion: .42–.67; contentment: .37–.58; joy: .33–.51; love: .37–.58; and pride: .36–.55) and factor loadings (awe: .36–.80; amusement: .52–.78; compassion: .65–.82; contentment: .76–.83; joy: .58–.72; love: .61–.76; and pride: .60–.74; Costello & Osborne, 2005).

We note that one item of the DPES awe scale, *I seek out experiences that challenge my understanding*, is very similar to an item on the CEI-II, *I am always looking for experiences that challenge how I think about myself and the world*. To ensure that findings are not being driven by these similar items, we also tested our hypothesis using a five-item awe scale that omits this item, and in presentation of results note how the results differ from the main findings presented.

**Positive and Negative Affect Schedule-short form (I-PANAS-SF).** Unlike the DPES, which assesses distinct positive emotions, the I-PANAS-SF measures the tendency to experience positively and negatively valenced activation (Thompson, 2007). Participants were asked to indicate the extent to which they generally feel each of five positive and five negatively valenced states on a scale from 1 (*never*) to 5 (*always*). To measure general positive activation the five items describing positive states were averaged: *determined, attentive, alert, inspired*, and *active*. In the current sample, positively valenced I-PANAS-SF scores were found to be both valid and reliable with an alpha estimate of .79 and the results of a 1-Factor exploratory analysis revealing acceptable communalities (.28–.65) and factor loadings (.53–.81).
Openness to Experience. Openness to Experience was measured by the Big Five Inventory (BFI) which assesses five broad personality dimensions (John & Srivastava, 1999). We focused on the 10-item Openness to Experience scale because it has been found to be related to both trait-level awe (Danvers & Shiota, 2016; Shiota et al., 2006) and curiosity (Kashdan et al., 2009, 2004; Kashdan & Steger, 2007; Mussel, 2010). Participants indicated how well each statement reflected their personality using a scale from 1 (strongly disagree) to 5 (strongly agree). Example items from the BFI Openness to Experience scale include: original, comes up with new ideas, and is creative and inventive. In the current sample, BFI scores were found to be reliable with an alpha estimate of .81. Lastly, BFI scores were also found to be structurally valid with a communality range of .23 to .57 and a factor loading range of .48 to .76.

Results

Analytic Approach. To test the unique association between trait awe and curiosity we ran three models. Given that Openness to Experience and general positive activation have both been shown to be related to curiosity (Gallagher & Lopez, 2007; Kashdan et al., 2009, 2004; Kashdan & Steger, 2007; Mussel, 2010), we first tested the relationship between awe and curiosity, controlling for both Openness and trait-level general activation. In the second model, to test the unique relationship between awe and curiosity above and beyond other trait positive emotions, we simultaneously regressed all seven scales of the DPES on trait curiosity. Finally, in the third and most stringent model, we entered Openness to Experience, trait general positive activation, and all seven DPES scales as predictors in a regression with trait curiosity as the outcome. This analytic plan distinguishes the current work from other research that has only examined the zero-order effects of trait awe on outcomes (Piff et al., 2015; Güsewell & Ruch, 2012) or controlled for positivity using only the PANAS and joy scale of the DPES (Stellar et al.,
2017) by demonstrating the unique effect of awe on curiosity above and beyond the influence of the other six trait positive emotions and relevant traits measured.

**Main Analyses.** The data and syntax used to generate these results can be found at [https://osf.io/7ztpu/?view_only=1625ac46c29041f6b8dbb5c74bd3fae1](https://osf.io/7ztpu/?view_only=1625ac46c29041f6b8dbb5c74bd3fae1). Data were z-scored within samples before being pooled. Zero-order correlations between measures are reported in Table 3. We tested the unique relationship between trait awe and curiosity in three increasingly stringent models, the results of which are displayed in Table 4. In the first model we found that after controlling for Openness to Experience and trait positive activation, awe was related to trait curiosity. In the second model we found that when controlling for the six other trait positive emotion assessed by the DPES, awe had a unique association with curiosity. Moreover, given that the 95% confidence interval (CI) of the effect of awe on trait curiosity did not overlap with that of amusement, compassion, contentment, joy, love, and pride, we concluded that awe had a significantly stronger relationship with curiosity than these other positive emotions. We note that in this model, we also found that pride was positively related to curiosity. In our third and most stringent model, we found that when controlling for Openness to Experience, trait positive activation, and all other trait positive emotions, awe remained significantly and positively related to trait curiosity. In this model both awe and pride were significantly related to curiosity, but even though the 95% CI of those effects overlapped, a z test comparing the coefficients (Clogg, Petkova, & Haritou, 1995) indicated that the effect of awe was significantly stronger, $z = 2.60, p = .009$. Trait amusement, compassion, contentment, joy, and love were not related to curiosity. Analyses run with the five-item awe scale omitting the item similar to one on the CEI-II yield the same pattern such that in the third model awe and pride are the only trait positive emotions that
are related to curiosity. However, we note that in this case the effect of awe is weaker, $\beta = .14$, $SE = .03$, $t = 4.14$, 95% CI [.08, .21].

In sum, Study 1 provides initial evidence of the unique link between trait awe curiosity, demonstrating that awe positively and uniquely related to curiosity when controlling for Openness to Experience, general positive affect, and six other discrete positive emotions. We also found a similarly strong relationship between pride and curiosity. Given that pride is often felt in response to gaining social status and acceptance (Tracy, Cheng, Robins, & Trzesniewski, 2009; Tracy & Robins, 2007) this effect is consistent with previous research linking social status enhancement-related appraisals of social situations with trait curiosity (Kashdan, Elhai, & Breen, 2008).

**Study 2: Trait awe and peer-ratings of curiosity**

In Study 1 we demonstrated in a large sample that when controlling for traits known to be related to curiosity such as Openness to Experience and trait positive activation, as well as trait amusement, compassion, contentment, joy, love, and pride, trait awe was uniquely related to curiosity. However, these findings are subject to the limitations of self-report methods (Paulhus & Vazire, 2007), most notably including self-perception and presentation biases. There is also conceptual overlap between awe and curiosity. For example, one usage of the English term *wonder*, a synonym for awe, can also be used to signify curiosity. To address these limitations, in Study 2 we used a peer-report approach to test how participants’ self-ratings of awe and other traits relate to how curious they are rated by their peers, which are not subject to participants’ individual biases or the conceptual overlap between awe and curiosity. We used the same analytic technique as in Study 1 to test the hypothesis that trait awe would be uniquely related to peer-rated curiosity by using increasingly stringent analyses to control for Openness to
Experience, trait positive activation, and the six other positive emotion scales: amusement, compassion, contentment, joy, love, and pride.

**Method**

**Participants.** One hundred and nineteen first-year undergraduate students were recruited to participate in a multi-phase study on the subject of awe in exchange for payment (see Table 1, Sample C for demographic characteristics). We recruited exclusively college freshmen because the first year of college often involves novel intellectual and social experiences, a rich time for both awe and curiosity to be experienced and expressed. We sampled from the student body at large, with only 8% of participants reporting psychology or cognitive science as their intended majors. Data presented in the current work overlap with that used by a previous report of the relationship between awe and humility (Stellar et al., 2017).

**Procedure.** Participants were recruited at the beginning of the semester via flyers posted throughout the university campus. After enrolling in the study, participants reported demographic information and completed trait measures. Participants then nominated four friends who attended the same university to take a brief survey concerning questions about both themselves and the participant. We contacted the first two peers on each participant’s list by email and offered them $5 in exchange for completing the survey. Additional peers were contacted as needed if the first two did not complete the survey. A total of 193 peers submitted reports for 100 of the participants enrolled in the study. When more than one peer rated a participant, scores were averaged.

**Measures.** In addition to demographic information, Openness to Experience (BFI), general positive activation (I-PANAS-SF), trait discrete positive emotions (DPES), and trait curiosity (CEI-II) were measured as in Study 1. Descriptive statistics for these measures can be
found in Table 2, Sample C. In the current sample, the scores of all three measures were found to be reliable with alpha estimates > .7 (BFI = .76, I-PANAS-SF = .72, and CEI-II = .81). In addition, factor analysis results indicated that BFI (.23–.78), I-PANAS-SF (.46–.75), and CEI-II (.27–.76) scores were structurally valid with acceptable ranges of factor loadings.

**Peer-rated curiosity.** Peers reported on the curiosity of the participant using three items adapted from the CEI-II (Kashdan et al., 2009): *your friend is the type of person who really enjoys the uncertainty of everyday life, everywhere your friend goes, he/she is looking for new things or experiences, and your friend views challenging situations as an opportunity to grow and learn*. Peers indicated how well they thought the statements described the participants on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*), and the three items were then averaged (*M* = 4.80, *SD* = .97, *α* = .81).

**Results**

The data and syntax used to generate these results can be found at [https://osf.io/7ztpu/?view_only=1625ac46c29041f6b8dd5c74bd3fae1](https://osf.io/7ztpu/?view_only=1625ac46c29041f6b8dd5c74bd3fae1). Measures were z-scored prior to analysis. Participants’ self-ratings of trait curiosity were significantly related to peer ratings of curiosity, *r*(98) = .25, *p* = .011. Using the same analytic approach as in Study 1, we used three increasingly stringent models to test if participants’ trait awe was uniquely associated with how curious they were rated by their peers. In the first model, controlling for Openness to Experience and trait positive activation, we found that trait awe was positively related to how curious participants were rated by their peers, *β* = .43, *SE* = .13, *t* = 3.36, *p* = .001, 95% CI [.17, .68]. In the second model, when entering all seven trait positive emotions as predictors, awe was significantly related to curiosity, *β* = .45, *SE* = .14, *t* = 3.31, *p* = .001, 95% CI [.18, .72]. Moreover, none of the other six trait positive emotions were related to peer-rated curiosity, |*β*s| ≤
.14, ps ≥ .29. Finally, in our third and most stringent model that controlled for Openness to Experience, trait positive activation, and trait positive emotions, awe remained related to peer-rated curiosity, $\beta = .45, SE = .16, t = 2.90, p = .005, 95\% \text{ CI} [.14, .76]$. Again, no other trait positive emotion was significantly related to peer-rated curiosity, $|\beta| < .12, ps > .30$. Analyses using the five-item awe scale yield the same pattern of findings such that awe is the only positive emotion scale to be related to curiosity, although slightly weaker, $\beta = .39, SE = .15, t = 2.60, p = .011, 95\% \text{ CI} [.09, .69]$. Taken together, these peer-report findings converge with those of Study 1 suggesting that trait awe is uniquely related to curiosity, above and beyond the effects of other trait positive emotions.

**Study 3: Trait Awe, Curiosity, and Academic Outcomes**

Together, Studies 1 and 2 show converging self and peer-report evidence that trait awe is uniquely related to curiosity. In Study 3, we aimed to demonstrate the importance of this relationship by examining its contribution to academic outcomes in a diverse sample of adolescents. Positive emotion traits in general have been previously linked to academic outcomes (Dixson, Anderson, Rigney, Niemasik, & Potte, 2018), but our aim in the current work was to demonstrate that the path by which trait awe relates to academic outcomes is via curiosity. Specifically, we hypothesized that awe would indirectly predict several academic outcomes (i.e., work ethic, behavioral engagement in school, and academic self-efficacy) via curiosity. To demonstrate that this relationship is unique—not part of a broader association between positive affect, curiosity, and academic outcomes (Gallagher & Lopez, 2007; Kashdan et al., 2009, 2004; Neff, Rude, & Kirkpatrick, 2007)—we tested this model controlling for trait joy. We hypothesized that the indirect effect of awe on academic outcomes via curiosity would remain even after controlling for joy.
Method

Participants and Procedure. The sample consisted of 447 high school adolescents (46.7% female) aged 12–19 (\(M_{age} = 15.8, SD = 1.28\)) attending an urban high school in a Midwestern state. The average grade point average of the sample was 2.88 (\(SD = .75\)). The self-reported ethnic breakdown of the sample was 55.8% European American/White, 25.3% African American/Black, 5.7% Hispanic American/Mexican, 3.0% Asian American/Pacific Islander, and 10.2% Multi-Ethnic/Other. In addition, the socioeconomic breakdown was self-reported as 9% Poor/Working Class, 15.5% Lower Middle Class, 54.2% Middle Class, 16.2% Upper Middle Class, 2.1% Lower Upper Class, and 2.1% Wealthy. The current study’s data were a subsection of data that were collected as a part of a school-wide improvement initiative to enhance the school climate. The school collected data on psychosocial factors (e.g., school belonging), positive emotions (e.g., the DPES), academic perceptions (e.g., academic self-regulation), and school personnel perceptions (e.g., perceptions toward teachers). The survey was administered during the students’ free period, with an allotted time of 45 minutes to complete the survey online from a school computer. All students who attended school on the two designated survey days participated in the data collection (>95% of total school population).

Measures. The following measures were used in this study.

Awe, joy, and curiosity. As in Study 1, trait awe and joy were measured with the DPES, and curiosity with the CEI-II. In the current sample, the scores of all three scales were found to be both reliable and structurally valid with acceptable reliability estimates (DPES-Awe, \(\alpha = .76\); DPES-Joy, \(\alpha = .86\); CEI-II, \(\alpha = .90\)) and exploratory factor analysis results (DPES-Awe [6-items], communality range = .16–.54, factor loading range = .40–.74; DPES-Joy, communality
range = .39–.68, factor loading range = .62–.82; CEI-II, communality range = .35–.67, factor loading range = .59–.82).

**Work ethic.** Work ethic was measured with the hard work subscale (HWS) of the Work Ethic Scale (Blau & Ryan, 1997). This 6-item scale measures both one’s philosophy on hard work and one’s belief in the utility of hard work (e.g., *If you work hard you will succeed*). Response options on this scale ranged from 1 (*Strongly disagree*) to 7 (*Strongly agree*). Higher scores on this scale indicate a higher willingness to engage in as well as a higher expected payoff from hard work. Previous studies have found HWS scores to be reliable (e.g., $\alpha = .85$; Blau & Ryan, 1997). In the current sample, HWS scores were found to be both reliable and structurally valid with an alpha of .90, and a 1-Factor exploratory factor analysis revealing a communality range of .53–.68 and a factor loading range of .73–.83.

**Behavioral engagement.** Behavioral engagement was measured with a reduced version of behavioral engagement subscale of the Engagement vs. Disaffection Scale (Skinner et al., 2008). This 4-item scale measures students’ willingness to participate in academic courses (e.g., *I pay attention in class*). Response options ranged from 1 (*Not true at all*) to 7 (*Very true*). Higher scores are indicative of both a higher behavioral engagement in the past and a higher willingness to participate in academic courses in the future. Behavioral engagement subscale scores have been found to be reliable in similar samples in previous research (alpha range of .71–.72; Skinner et al., 2008). In the current sample, behavioral engagement subscale scores were found to be both valid and reliable with an alpha estimate of .81, and a 1-Factor exploratory factor analysis revealing a communality range of .245–.846 and a factor loading range of .495–.920.
Academic self-efficacy. Academic self-efficacy was measured with the self-efficacy for academic achievement subscale (ASE) of the Children’s Multidimensional Self-Efficacy Scale (Bandura, 1990; Zimmerman & Ban, 1992). This 8-item subscale assesses how strongly students believe they can achieve in academic subjects. The subscale is prefaced with the phrase “How well can you learn…” and the items consist of school subjects (e.g., general mathematics, algebra, science, biology, and social studies). Response options ranged from 1 (Not at all) to 6 ( Extremely well), with higher scores indicating a stronger belief in one’s academic ability. Previous research in similar samples indicate that ASE scores are reliable with alpha estimates ranging from .70 to .81 (Dixson, Worrell, Olszewski-kubilius, & Subotnik, 2016; Zimmerman & Ban, 1992). In the current sample, ASE scores were found to be both reliable and structurally valid with an alpha estimate of .85, and a 1-Factor exploratory factor analysis revealing a communality range of .314–.633 and a factor loading range of .534–.796.

Results

Preliminary analyses. Means, standard deviations, and intercorrelations are presented in Table 5. Although no differences across study variables were found for race, several differences were found for gender, all in keeping with the extant literature. Females reported significantly higher work ethic ($p = .02, g = .23$) and behavioral engagement ($p = .01, g = .25$) than males, albeit all with small effect sizes.

Primary analyses. A series of structural equation models (SEMs) were used to assess whether awe indirectly affects behavioral engagement, academic self-efficacy, and work ethic via curiosity. Assessing this indirect relationship via SEM has the advantage of decreasing measurement error and the capability to assess more complicated models when compared to traditional methods (see Baron & Kenny, 1986; Gunzler, Chen, Wu, & Zhang, 2013). Consistent
with best practice, a weighted least squares means and variance adjusted (WLSMV) estimator was used for analysis and multiple fit indices were used to assess the fit of the theorized model to the data (Muthén & Muthén, 1998-2012). Generally, indicators of good fit include a non-significant chi square, a comparative fit index (CFI) value that is greater than or equal to .90, a Tucker Lewis Index (TLI) value that is greater than or equal to .90, and a Root Mean Square Error of Approximation (RMSEA) value below .08 (Kenny, 2015; Maccallum, Browne, & Sugawara, 1996; Marsh, Hau, & Wen, 2004). However, Kenny (2015) asserted that the chi square is an inappropriate measure of fit for sample sizes over 400 because these models almost always have a significant chi square. Thus, the chi square was not used as an indicator of good fit in the current analysis.

The first model started with awe, continued through curiosity, and ended with academic self-efficacy, behavioral engagement in school, and work ethic simultaneously (see Figure 1). Consistent with previous research (Dixson et al., 2018) curiosity, work ethic, behavioral engagement, and academic self-efficacy were correlated in the model. Fit indices for this model were as follows: Chi square ($\chi^2$) = 1781.49 (degrees of freedom = 519, $p < .0001$), CFI = .918, TLI = .911, and RMSEA = .074 (90% CI: .070 to .078). Given that the model had an acceptable CFI, TLI, and RMSEA, it was concluded that the model had overall good fit. Further, indirect analyses revealed that awe predicted academic self-efficacy ($\beta = .503, SE = .040, p < .001$), behavioral engagement ($\beta = .315, SE = .037, p < .001$), and work ethic ($\beta = .354, SE = .034, p < .001$), with the model as a whole accounting for 59.4% of curiosity’s variance, 3.7% of academic self-efficacy’s variance, 16.7% of behavioral engagement in school’s variance, and 21.1% of work ethic’s variance. Taken together these findings support our hypothesis that trait awe indirectly predicts academic outcomes via curiosity. Finally, the standardized beta loadings for
awe items (β range = .433–.833), curiosity items (β range = .578–.845), academic self-efficacy items (β range = .677–.838), work ethic items (β range = .806–.879), and behavioral engagement items (β range = .652–.918) were all acceptable within the model. A similar pattern of results was found using the five-item awe scale.

To test that this pattern is unique to awe, and not part of a more general pattern between positive emotions more generally and curiosity and academic outcomes, we then tested if this relationship held when controlling for trait joy. We tested a second model that included a path from joy to the school outcomes via curiosity. The second model started with both awe and joy, continued through curiosity, and concluded with academic self-efficacy, behavioral engagement, and work ethic simultaneously. The results of this model were as follows: Chi square ($\chi^2$) = 2382.57 (degrees of freedom = 730, $p < .001$), CFI = .900, TLI = .894, and RMSEA = .071 (90% CI: .068 to .074). Given that the CFI and RMSEA were acceptable and the TLI was very close to acceptability, it was concluded that the model exhibited good fit. Follow-up indirect analyses revealed that awe indirectly predicted academic self-efficacy ($\beta = .548, SE = .068, p < .001$), behavioral engagement ($\beta = .375, SE = .052, p < .001$), and work ethic ($\beta = .407, SE = .051, p < .001$) via curiosity even after controlling for the joy to academic self-efficacy, behavioral engagement, and work ethic via curiosity pathways in the model. Importantly, in this model joy was not indirectly related to academic self-efficacy ($\beta = -.035, SE = .057, p = .544$), behavioral engagement ($\beta = -.024, SE = .039, p = .543$), and work ethic ($\beta = -.026, SE = .042, p = .542$) via curiosity. The model accounts for 58.6% of curiosity’s variance, 2.7% of academic self-efficacy’s variance, 21.6% of behavioral engagement’s variance, and 25.5% of work ethic’s variance. These results support our hypothesis that awe, and not positive emotions in general, indirectly affects academic self-efficacy, behavioral engagement, and work ethic via curiosity.
Finally, the standardized beta loadings for awe items (β range = .437–.766), joy items (β range = .637–.810), curiosity items (β range = .561–.834), academic self-efficacy items (β range = .680–.837), work ethic items (β range = .812–.879), and behavioral engagement items (β range = .667–.917) were all acceptable within the model. A similar pattern of results were found using the five-item awe scale.

**General Discussion**

The life narratives of famous scientists and explorers like Marie Curie, Albert Einstein, and John Muir suggest that people who often and intensely feel awe are also highly curious. In the current work we provided the first empirical evidence that trait awe is uniquely related to curiosity. In Study 1 using a self-report approach we showed that people who were higher in trait awe were on average higher in curiosity. In Study 2 we provided converging evidence using a peer-report approach. More specifically, we found that the higher people were in trait awe the more curious they were rated by their friends on average. Importantly, the findings from these two studies held when controlling for Openness to Experience, trait positive affect, and six other trait positive emotions—amusement, compassion, contentment, joy, love, and pride—confirming our hypothesis that trait awe is uniquely related to trait curiosity. Having demonstrated this unique effect, in Study 3 we showed its importance by testing its relationship with academic outcomes such as work ethic, behavioral engagement in school, and academic self-efficacy. Using an SEM approach, we found that trait awe indirectly predicted all three academic outcomes via trait curiosity even when controlling for trait positivity. Taken altogether, these findings demonstrate the roles that awe and curiosity play in how people learn about the world.

While we consistently demonstrated a unique relationship between awe and curiosity this does not suggest that awe is the only predictor of curiosity. Consistent with previous work
(Gallagher & Lopez, 2007; Güsewell & Ruch, 2012; Kashdan et al., 2009, 2004) we found that both Openness to Experience and trait positive activation were strongly related to curiosity. In terms of other trait positive emotions, pride also emerged as a predictor of curiosity. This is consistent with previous work linking social status enhancement behaviors and curiosity (Kashdan et al., 2008) and consistent with the notion that people with high status have more physical and social capital to support exploratory behavior.

While the theoretical framing of this work suggests a directional influence of awe on curiosity, we note that current data cannot speak to causality. A bidirectional relationship is possible, such that people who are more curious feel awe more frequently because their exploration expose them to more vast and novel experiences. Experimental research is needed to confirm the causal effect of awe on curiosity. Given the results from Study 1, pride may be a stringent comparison condition for such work to test if awe increases curiosity above and beyond the effect of other positive emotions, although we note that pride was not related to peer-rated curiosity in Study 2.

Another future direction suggested by the current work is testing the potential of awe interventions to bolster curiosity and thus academic outcomes. Previous research has shown that trait awe is related to science learning (Gottlieb et al., 2018), but the results from Study 3 suggest that awe and curiosity relate to broader academic outcomes such as work ethic and behavioral engagement in school. Together with emerging evidence that awe promotes creativity (Zhang et al., 2018) and systematic processing of information (Danvers & Shiota, 2016; Griskevicius et al., 2010), the current work raises the possibility that experiences of awe may enhance a suite of cognitive capabilities that foster learning. Empirical evidence along these lines would highlight the importance of providing real world experiences of awe to youth in schools through nature
experiences (Anderson, Monroy, & Keltner, 2017, 2018; Piff et al., 2015), trips to museums, and cultural exchanges.

In conclusion, we provided the first evidence that awe-prone people are more curious, a finding that is consistent with the life narratives of scientists and explorers that have changed human history through their exploration. Our findings suggest that experiences of awe may play an important role in sparking the curiosity of the future generation of Einsteins and Curies.
Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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### Table 1

**Demographic characteristics of Study 1 samples**

<table>
<thead>
<tr>
<th></th>
<th>Sample A</th>
<th>Sample B</th>
<th>Sample C</th>
<th>Sample D</th>
<th>Sample E</th>
<th>Sample F</th>
<th>Total sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>n</strong></td>
<td>161</td>
<td>278</td>
<td>119</td>
<td>174</td>
<td>155</td>
<td>118</td>
<td>1,005</td>
</tr>
<tr>
<td><strong>Mean age</strong></td>
<td>20.47</td>
<td>20.66</td>
<td>18.40</td>
<td>35.87</td>
<td>20.89</td>
<td>21.31</td>
<td>23.29 (8.46)</td>
</tr>
<tr>
<td>(SD)</td>
<td>(2.04)</td>
<td>(4.15)</td>
<td>(.66)</td>
<td>(12.41)</td>
<td>(2.52)</td>
<td>(2.80)</td>
<td></td>
</tr>
<tr>
<td><strong>% Female</strong></td>
<td>74%</td>
<td>65%</td>
<td>70%</td>
<td>58%</td>
<td>77%</td>
<td>75%</td>
<td>69%</td>
</tr>
<tr>
<td><strong>Type</strong></td>
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<td>Psych</td>
<td>First-year</td>
<td>mTurk</td>
<td>Psych</td>
<td>Psych</td>
<td>-</td>
</tr>
<tr>
<td></td>
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<td>Undergrad</td>
<td>Undergrad</td>
<td>Undergrad</td>
<td>Undergrad</td>
<td>Undergrad</td>
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</tr>
<tr>
<td><strong>% Asian</strong></td>
<td>65%</td>
<td>50%</td>
<td>65%</td>
<td>1%</td>
<td>62%</td>
<td>42%</td>
<td>47%</td>
</tr>
<tr>
<td><strong>% Black</strong></td>
<td>1%</td>
<td>3%</td>
<td>5%</td>
<td>11%</td>
<td>3%</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td><strong>% White</strong></td>
<td>27%</td>
<td>40%</td>
<td>22%</td>
<td>85%</td>
<td>34%</td>
<td>48%</td>
<td>44%</td>
</tr>
<tr>
<td><strong>% Pacific</strong></td>
<td>2%</td>
<td>1%</td>
<td>0%</td>
<td>0%</td>
<td>3%</td>
<td>3%</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Islander</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>% Native</strong></td>
<td>1%</td>
<td>2%</td>
<td>0%</td>
<td>3%</td>
<td>2%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td><strong>American</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Table 2

*Descriptive statistics of Study 1 measures by sample*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Sample A</th>
<th>Sample B</th>
<th>Sample C</th>
<th>Sample D</th>
<th>Sample E</th>
<th>Sample F</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEI-II</td>
<td>3.35 (.64)</td>
<td>3.52 (.61)</td>
<td>3.48 (.58)</td>
<td>4.71 (1.15)</td>
<td>4.66 (1.02)</td>
<td>3.01 (.76)</td>
</tr>
<tr>
<td>DPES-awe</td>
<td>4.86 (.89)</td>
<td>4.97 (.83)</td>
<td>4.87 (1.03)</td>
<td>4.99 (1.04)</td>
<td>4.98 (.95)</td>
<td>4.90 (1.03)</td>
</tr>
<tr>
<td>DPES-amusement</td>
<td>4.91 (.98)</td>
<td>5.11 (.91)</td>
<td>5.26 (1.16)</td>
<td>4.81 (1.06)</td>
<td>4.96 (.99)</td>
<td>5.21 (1.06)</td>
</tr>
<tr>
<td>DPES-compassion</td>
<td>5.44 (1.00)</td>
<td>5.41 (.91)</td>
<td>5.48 (.93)</td>
<td>5.47 (1.10)</td>
<td>5.67 (.76)</td>
<td>5.74 (.86)</td>
</tr>
<tr>
<td>DPES-contentment</td>
<td>4.77 (1.13)</td>
<td>4.83 (1.02)</td>
<td>4.84 (1.25)</td>
<td>4.71 (1.25)</td>
<td>4.81 (1.21)</td>
<td>4.78 (1.29)</td>
</tr>
<tr>
<td>DPES-joy</td>
<td>4.72 (.98)</td>
<td>4.79 (.92)</td>
<td>4.80 (1.05)</td>
<td>4.62 (1.13)</td>
<td>4.71 (1.04)</td>
<td>4.63 (1.11)</td>
</tr>
<tr>
<td>DPES-love</td>
<td>4.72 (1.08)</td>
<td>4.80 (.95)</td>
<td>4.56 (1.14)</td>
<td>4.62 (1.16)</td>
<td>4.89 (1.02)</td>
<td>4.79 (1.11)</td>
</tr>
<tr>
<td>DPES-pride</td>
<td>4.93 (.99)</td>
<td>5.03 (.86)</td>
<td>5.07 (.97)</td>
<td>4.89 (.99)</td>
<td>4.89 (.97)</td>
<td>5.07 (1.05)</td>
</tr>
<tr>
<td>BFI-openness</td>
<td>3.58 (.57)</td>
<td>3.67 (.57)</td>
<td>3.74 (.49)</td>
<td>3.83 (.56)</td>
<td>3.51 (.52)</td>
<td>3.56 (.62)</td>
</tr>
<tr>
<td>PANAS-positive</td>
<td>3.38 (.81)</td>
<td>3.50 (.70)</td>
<td>3.76 (.57)</td>
<td>3.64 (.69)</td>
<td>3.49 (.65)</td>
<td>3.56 (.62)</td>
</tr>
</tbody>
</table>

*Note.* CEI-II = Curiosity and Exploration Inventory II (Kashdan et al., 2009); DPES = Dispositional Positive Emotion Scale (Shiota, Keltner, & John, 2006); PANAS-positive = positive activation items from International Positive and Negative Affect Schedule Short Form (I-PANAS-SF; Thompson, 2007); BFI = Big Five Inventory (John & Srivastava, 1999). In Samples D and E the CEI-II was presented on a seven-point scale, and in the remaining samples on a five-point scale.
Table 3

Zero-order correlations and alpha estimates of Study 1 measures

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CEI-II</td>
<td>(.93)</td>
<td>.55</td>
<td>.29</td>
<td>.30</td>
<td>.37</td>
<td>.43</td>
<td>.29</td>
<td>.44</td>
<td>.50</td>
</tr>
<tr>
<td>2</td>
<td>DPES-awe</td>
<td>(.78)</td>
<td>.41</td>
<td>.49</td>
<td>.53</td>
<td>.63</td>
<td>.48</td>
<td>.47</td>
<td>.50</td>
<td>.40</td>
</tr>
<tr>
<td>3</td>
<td>DPES-amusement</td>
<td>(.77)</td>
<td>.30</td>
<td>.31</td>
<td>.46</td>
<td>.36</td>
<td>.29</td>
<td>.27</td>
<td>.15</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>DPES-compassion</td>
<td>(.86)</td>
<td>.30</td>
<td>.44</td>
<td>.44</td>
<td>.33</td>
<td>.30</td>
<td>.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>DPES-contentment</td>
<td>(.90)</td>
<td>.74</td>
<td>.57</td>
<td>.68</td>
<td>.17</td>
<td>.40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>DPES-joy</td>
<td>(.83)</td>
<td>.62</td>
<td>.62</td>
<td>.29</td>
<td>.43</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>DPES-love</td>
<td>(.82)</td>
<td>.48</td>
<td>.17</td>
<td>.27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>DPES-pride</td>
<td>(.80)</td>
<td>.29</td>
<td>.44</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>BFI-openness</td>
<td>(.81)</td>
<td>.26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>PANAS-positive</td>
<td></td>
<td>(.79)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

Note. Alpha estimates are provided on the diagonal in parentheses. All correlations are significant at $p < .001$ level.
Table 4

*Study 1 Regression models demonstrating the unique relationship between trait awe and curiosity*

<table>
<thead>
<tr>
<th></th>
<th>$\beta$</th>
<th>SE</th>
<th>t</th>
<th>$p$</th>
<th>95%CI</th>
</tr>
</thead>
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<td><strong>Model 1</strong></td>
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<td></td>
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</tr>
<tr>
<td>DPES-awe</td>
<td>.35</td>
<td>.03</td>
<td>11.70</td>
<td>&lt;.001</td>
<td>[.29, .40]</td>
</tr>
<tr>
<td>BFI-open</td>
<td>.32</td>
<td>.03</td>
<td>10.10</td>
<td>&lt;.001</td>
<td>[.26, .39]</td>
</tr>
<tr>
<td>PANAS-positive</td>
<td>.14</td>
<td>.03</td>
<td>5.36</td>
<td>&lt;.001</td>
<td>[.09, .19]</td>
</tr>
<tr>
<td><strong>Model 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DPES-awe</td>
<td>.43</td>
<td>.04</td>
<td>12.44</td>
<td>&lt; .001</td>
<td>[.36, .50]</td>
</tr>
<tr>
<td>DPES-amusement</td>
<td>.04</td>
<td>.03</td>
<td>1.59</td>
<td>.11</td>
<td>[-.01, .10]</td>
</tr>
<tr>
<td>DPES-compassion</td>
<td>.01</td>
<td>.03</td>
<td>0.23</td>
<td>.82</td>
<td>[-.05, .06]</td>
</tr>
<tr>
<td>DPES-contentment</td>
<td>-.04</td>
<td>.04</td>
<td>-1.24</td>
<td>.22</td>
<td>[-.11, .03]</td>
</tr>
<tr>
<td>DPES-joy</td>
<td>.04</td>
<td>.04</td>
<td>0.95</td>
<td>.35</td>
<td>[-.04, .12]</td>
</tr>
<tr>
<td>DPES-love</td>
<td>-.05</td>
<td>.03</td>
<td>-1.52</td>
<td>.13</td>
<td>[-.11, .02]</td>
</tr>
<tr>
<td><strong>DPES-pride</strong></td>
<td>.23</td>
<td>.03</td>
<td>6.80</td>
<td>&lt; .001</td>
<td>[.16, .29]</td>
</tr>
<tr>
<td><strong>Model 3</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>DPES-awe</td>
<td>.28</td>
<td>.04</td>
<td>7.76</td>
<td>&lt; .001</td>
<td>[.21, .35]</td>
</tr>
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<td>DPES-amusement</td>
<td>.03</td>
<td>.03</td>
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<td>[-.02, .08]</td>
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<tr>
<td>DPES-compassion</td>
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<td>.03</td>
<td>-.82</td>
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<td>DPES-contentment</td>
<td>.01</td>
<td>.03</td>
<td>.21</td>
<td>.84</td>
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<tr>
<td>DPES-joy</td>
<td>.02</td>
<td>.04</td>
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<td><strong>DPES-pride</strong></td>
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<td>.03</td>
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<td>&lt; .001</td>
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<td>.03</td>
<td>9.68</td>
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<td>.03</td>
<td>3.32</td>
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Table 5

*Descriptive statistics and zero-order correlations between Study 3 measures*

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*Note.* All $p$ values < .003.
Figure 1. Standardized pathways from awe to academic outcomes via curiosity. 
*p < .001.