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# Creative Development as An Agentic Process: Five Distinct Trajectories of Divergent Thinking Originality Across Early Adolescence

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## Highlights

- Most students showed a decline in divergent thinking originality from Grade 6–8
- Five percent of sample demonstrated creative potential growth across years
- Malleable factors such as growth mindset and environmental support predicted growth
- Creative potential likely contributes to healthy agentic adolescent development

**Abstract**

This study linked adolescents' creative development across three years to adaptive, maladaptive, and environmental predictors with the aim of describing different trajectories of creative development and the degree to which those trajectories relate to differences in students' preparation for high school. Latent class growth analysis provided estimates of these trajectories. Results indicated that higher levels of creative development in divergent thinking originality in Grades 6–8 were predicted by malleable environmental, adaptive, and affective factors. Five groups were detected with most students identified by a group demonstrating low levels of originality at Grade 6 with a gradual decline across time. Groups with higher levels of originality in Grade 6 or with positive trends of growth across middle school had higher levels of agentic, academic, creative, and school engagement outcomes at the end of Grade 8 compared to the normative gradually declining group, at medium to very large effect sizes. Results indicated that creative potential development is an agentic process and likely contributes to healthy development in adolescence. Many factors predicting higher trajectories are malleable and can be influenced by the learning environment and instruction.

**Keywords:** *creative potential; adolescence; mindset; agency; developmental trajectories*

## Educational Relevance Statement

This study measured and plotted students' creative potential at five time points across Grades 6–8 in eight U.S. middle schools. Most early adolescent students in this study demonstrated a decline in their creative potential measured by creative ideation tasks. Some students demonstrated growth and that growth was predicted by having a growth mindset about ability, experiencing flow in learning, feeling engaged in school, and valuing social conformity less. Results also indicated that creative potential development likely contributes to healthy and agentic development in adolescence. This study reveals the importance of supporting students' individual creative development and provides some factors that educators can consider in their instruction and curriculum.

# Creative Development as an Agentic Process: Five Distinct Trajectories of Divergent Thinking Originality Across Early Adolescence

The potential to generate creative possibilities is considered one of the most important assets to the future success of individuals and organizations in an increasingly complex, volatile, and uncertain world (IBM, 2010; Woodward, 2017). This potential for creativity can buttress young people with adaptability in the face of the many unknowns that life brings. During adolescence, creative potential supports the difficult developmental task of identity formation (Barbot & Hueser, 2017; Karwowski, 2016; Sica et al., 2017) and consistently links to better academic performance (Gajda et al., 2016). Unfortunately, most educational settings do not prioritize the development of creative potential and struggle to incorporate the often counterintuitive features needed to optimize creative development (Beghetto & Kaufman, 2014). In fact, a review of observation studies found very little evidence of creative learning opportunities in schools (Katz-Buonincontro & Anderson, 2018)

This disjuncture between the demands of a fast-changing world, adolescent needs, and formal education may be problematic for the preparation of young people for flourishing in the uncertainty of the world they will lead (Beghetto, 2019). Within this context where creativity is undervalued, little is known about how creative potential develops across the early adolescent years in middle school. Existing research often consists of contradictory results. No study to date has identified the different types of patterns that may exist for individual students and the personal and environmental factors that may contribute to those different trajectories. Without a better understanding of the development and consequential role of creative potential, this resource to young people will continue to be ignored. This study employed a person-centered approach (Nagin, 2005) and social cognitive theory (Bandura, 1986) perspective to begin to fill

this gap.

**Defining Creative Potential Development**

Creativity can be thought of as the interaction of aptitude, process, and environment to produce novel, meaningful, and effective ideas, processes, or products within a specific sociocultural context (Plucker, Beghetto, & Dow, 2004). Divergent thinking (DT) has been one common approach to isolating the cognitive ability of creative ideation by asking individuals to generate ideas in response to open-ended prompts, such as coming up with different uses for a common object (Barbot, 2018). DT is only one manifestation of potential within a diverse set of *creative resources* that contribute to the creative person and process (Anderson, 2020; Barbot, Lubart, & Besancon, 2016), such as creative thinking, creative behaviors, creative self-beliefs, and creative attitudes. For instance, attitudes toward unconventionality (Andreas et al., 2016) and self-beliefs about creativity (Karwowski & Beghetto, 2018) both shape creative thought and action.

DT originality, specifically, is one assessed dimension that estimates an individual's capacity to generate multiple unusual and original ideas in response to an open-ended stimulus compared to ideas generated by others within a sample (Barbot & Reiter-palmon, 2019). DT is predictive of future creative achievement (Reiter-Palmon et al., 2019), though it generally explains a small amount of variability in creative behavior and achievement based on the results of two large meta-analyses (Kim, 2008; Said-Metwaly et al., 2022). Recent research found that DT originality contributed more to outcomes of creative self-beliefs and metacognition in early adolescence, compared to DT fluency (i.e., number of ideas) and flexibility (i.e., number of categories of ideas; Anderson & Graham, 2021). That research provided some evidence of trustworthiness of the valid use of the *Alternate Uses Task* (AUT or also known as the *Many*

*Uses Game*) with alternate forms across time to learn about the nature of creative potential development in early adolescence. However, issues exist in how to interpret the results, discussed later in this study (see Barbot, 2019 for a thorough review).

## Understanding Change in Creative Potential Across Early Adolescence

DT originality of ideas (i.e., different uses of a spoon or some other common object) scored across three years could provide important understanding of creative potential development (Barbot, 2019). For these trajectories to be meaningful, it is important to understand their relationships to other important aspects of youth development, such as self-beliefs, motivation and engagement, and academic readiness. This current study aims to identify different trajectories of DT originality to find out how they relate to other aspects of healthy youth development. During adolescence, especially—a period marked by highly dynamic biological and social growth (Dahl et al., 2018; Eccles & Roeser, 2011)—different fluctuations in creative potential likely exist. Those fluctuations may relate to different individual and environmental factors that warrant greater attention (Barbot et al., 2016).

### *Creative Potential in Adolescence*

Past research suggested a lack of cognitive sophistication may limit the creative potential of learners before the early adolescent years (e.g., 10–11 years old; Smith & Carlsson, 1983). Others found that learners in the middle years became more concerned about representational accuracy in visual artwork (Rosenblatt & Winner, 1988) and gained evaluative thinking to judge the appropriateness of ideas, perhaps limiting originality (Runco, 2007). Relatedly, developmental science indicates the value of social relationships and the pressures to achieve acceptance and a sense of belonging from peers intensifies during early adolescence (Dahl et al., 2018). Though those pressures could reduce adolescents' willingness to be original for fear of

not being accepted, Kleibeuker et al. (2016) found the quality and originality of divergent thinking responses improved across adolescence. From a cognitive and developmental perspective, those improvements may result from knowledge increases, a growing prefrontal cortex, and maturing cognitive processes that facilitate flexible associations and explorative thinking (Kleibeuker et al., 2016). That growth could also result, in part, from the need in adolescence for risk-taking and seeking of emotional arousal in learning (Dahl et al., 2018).

Therefore, some evidence points to increased ability to identify and select unusual associations across unrelated categories, supporting a perspective that complementary creative resources may mature together through this period of development. However, much of that research was conducted in a laboratory setting where the influence of social and cultural factors is reduced. In analyses conducted with the same data in this current study in the school setting (Anderson & Graham, 2021), results suggested DT fluency and originality did not change, on average, from Grade 6–8, but DT flexibility increased slightly. Those results contrast with the results from a recent meta-analysis (Said-Metwaly et al., 2021), which suggested a positive trend across the middle years, albeit with a substantial Grade 7 slump for DT originality.

### *Developmental Trends in Divergent Thinking*

Research on developmental trends of divergent thinking has spent substantial effort trying to explain specific developmental slumps identified in cross-sectional research. Explanations appear through an array of sociocultural, socioemotional, and cognitive perspectives, including (a) the effects of critical grade-to-grade transitions in school (He & Wong, 2015), (b) normative effects of more strict classroom environments (Torrance, 1968), (c) cultural differences, such as early emphasis on college entrance exams in China (Yi, Hu, Plucker, & McWilliams, 2013), and (d) socioeconomic characteristics of the school and the different

educational resources, experiences, and pressures those characteristics afford (Dai et al., 2012). The role that environmental, social, personal, and affective factors play has been studied less than these other areas—a gap this study aims to begin to fill.

## Developmental Change in Creative Potential from an Agentic Perspective

Student agency in learning is a combination of both person-level factors, such as self-efficacy and perceived control, and interpersonal factors such as relational support from others and vicarious experience, modeling, and a supportive environment (Bandura, 1986). Framing creativity through an agentic perspective, the creative behavior as agentic action model (Karwowski & Beghetto, 2018) suggests young people actualize their creative potential in an educational context through their valuing of creativity and their self-beliefs, sense of control, and metacognitive knowledge and skills related to creativity (Anderson & Haney, 2021). The agentic nature of creative potential and development during early adolescence implicates environmental and adaptive and maladaptive personal factors—Figure 1 illustrates factors included in this study.

### *Adaptive Factors Toward Creative Potential Growth*

A primary adaptive and agentic predictor of student creative potential growth should be *self-confidence* in their creative ideas (Karwowski & Barbot, 2016). Relatedly, achieving a state of *flow in learning* in school would reflect an intense focus and enjoyment in productive challenge (Csikszentmihalyi & Rathunde, 1993) and more experiences of intrinsic enjoyment, deep concentration, and interest in school could lead to better engagement in creative tasks. A *growth mindset* about the malleability of ability through dedicated effort buffers students' effort and achievement (Claro et al., 2016; Jacovidis et al., 2020) and should undergird a students' proactive orientation toward risk and challenges needed for creative growth. Middle school

students sampled from this same study population for focus groups described these factors as playing a role in their creativity in learning (Anderson et al., 2020)—all three should be adaptive for maintaining high levels of DT originality or experiencing growth.

### *Maladaptive Factors Undermining Creative Growth*

Creative risk-taking in a social environment becomes heightened during early adolescence (Anderson et al., 2020) and requires breaking from the norms and expectations of others. Overvaluing *social conformity* at the onset of adolescence could relate to a decline in creative development—this tension may be powerful given how crucial peer approval feels (Dahl et al., 2018). *Anxiety* and *disengagement* in school might also predict creative potential decline in early adolescence. Heightened anxiety over performance in school could result in suppressed creative action if stakes feel high. Affective disengagement to school leads to weaker sense of agency, lower attendance, and weaker academic performance (Anderson et al., 2019), which could contribute to a dip in creative potential development. These are three distinct maladaptive factors that may predict creative potential decline.

### *Environmental Factors*

During the early adolescent years, middle schools typically provide less curricular freedom for creative opportunities than elementary schools. Complex concerns about how to structure the educational experience of "middle level" learners during adolescence have resulted in a continued emphasis on academic preparedness and competition over individual and developmental growth (Juvonen et al., 2004). The result has produced learning conditions that heighten many students' dissatisfaction, disengagement, and emotional distress—all likely negative influences on creative potential in adolescence. One conducive approach to cultivate creative potential is to integrate the arts into different middle school subject areas (Anderson et

al., 2020). Though this curricular integration is complex, exposure could offset some of those potentially negative influences of the middle school environment. The unique context of this study provides the opportunity to test that influence. Additionally, students' perception of support for creativity may be of even greater importance, given that quality arts integration depends on the training and approach of the teacher (Anderson, Porter, & Adkins, 2020).

Access to financial resources at home can determine opportunities for creative development prior to and during early adolescence (Dai et al., 2012), so this socioeconomic factor should be included. The cognitive, behavioral, and social-emotional differences of students in special education may also predict differences in development of creative potential. Last, research on gender differences in creative development has been inconclusive (Abraham, 2016), but stressors of masculinity norms could disadvantage adolescent males (Connell, 2005; Marasco, 2018) and contribute to the result of male students experiencing a Grade 7 slump in divergent thinking scores more severely than female students (Said-Metwaly et al., 2021). These three demographic variables should be included as predictors.

**Exploring Outcomes Predicted by Creative Potential Growth**

To further understand the validity of different trajectories of creative potential, this study explores several outcomes. Student agency is a protective factor from deteriorating engagement in the middle to high school transition, leading to higher academic performance (Anderson et al., 2019). Higher creative development during middle school could predict higher levels of personal agency in school. Students' academic achievement and engagement in school should relate to greater creative potential growth, given this association in past research (Gajda et al., 2016). Actual creative production and creative self-concept in school would likely be associated with stronger trajectories in creative potential.

## Research Questions

In this exploratory study, group-based trajectory modeling (Nagin, 2005) was used to model change in student DT originality and detect different latent groups of student growth. That modeling approach explored how different profiles of adaptive, maladaptive, and environmental characteristics influenced trajectories of originality. The approach to detecting distinct homogenous groups of creative growth set up analyses to link patterns to a multidimensional set of outcomes. The aims of this study address three research questions.

1. What are the distinct latent trajectory groups of DT originality for students during middle school Grades 6–8?
2. Do adaptive and maladaptive personal and environmental factors predict membership in distinct latent trajectory groups of DT originality compared to a baseline group of lower DT originality?
3. Compared to groups with low DT originality at the start of Grade 6 and across Grades 6–8, do students in classes of higher DT originality demonstrate higher levels of students' academic, creative, agentic, and engagement outcomes?

# Materials and Method

This study applied a person-centered approach to model developmental trajectories applying techniques used in a range of investigations, from depressive trajectories of North American indigenous youth (Martinez & Armenta, 2020) to identifying atypical cortisol patterns in children (Ryzin et al., 2009). As reported in past research (Anderson & Graham, 2021; Anderson & Haney, 2021; Anderson, Pitts, & Smolkowski, 2017), four of the eight schools had been selected by district officials for a school improvement project to support student engagement and student growth in math and reading achievement through arts integration in

curriculum and instruction. The other four schools were non-equivalent comparison sites in that initiative, similar in instructional approach and demographic composition. As such, arts integration exposure was included as an environmental predictor. The following section describes the sample, settings, procedure, measures, and analytic approach. The study followed all human subjects research protocol and ethics approved by an institutional review board.

**Participants**

The sample in this study included middle school students from schools in the Pacific Northwest, who began Grade 6 in 2015 and completed Grade 8 in 2018. An initial sample of $n$ = 1,025 Grade 6 students increased to $N$ = 1,299 by Grade 8 with new students joining and others leaving. In the sample, 67.4% of students were white, 20% were Hispanic, 8.2% were multiracial, and between 0.5–1.5% were Black, American Indian/Native Alaskan, Asian, or Native Hawaiian/Pacific Islander. Across the full sample, 47.6% were female[1], 6.3% were classified as English language learner, and 16.1% identified for special education services. Fifty-eight percent of students were eligible for free or reduced meals. The socioeconomic marginalization of this sample is important to acknowledge when interpreting and generalizing results. All participants consented to this research in accordance with human subjects guidelines and with approval from the governing institutional review board.

**Setting**

Participating students attended $N$ = 8 middle schools in four mostly urban school districts. According to publicly available data, the participating middle schools served a student population that ranged from 50–95% economically disadvantaged, which may have contributed

[1] Student sex was reported through district and state administrative data. We did not have data on students' self-reported gender identification.

to missing data issues.

## Procedures

Classroom teachers introduced and oversaw student completion of online survey assessments through a computer or tablet. Several students in each wave experienced technical difficulties with their computer or tablet and completed the survey and tasks using a pencil and paper format. This variation only happened several times each wave. Students received sufficient time to respond to open-ended and close-ended items within a standard 55-minute class period. Survey instructions for students emphasized that the survey was not a test and was used solely for research and evaluation to support the school's efforts to improve the student learning experience. The protocol placed open-ended, divergent thinking tasks between different close-ended survey items to enhance interest and disrupt response patterns. The affordances of those DT idea generation tasks allowed for computer-based administration. The Wave 6 creative production assessment required students complete a drawing, therefore a paper and pencil format was most appropriate. Given the differences between the DT tasks and the creative production task, it is unlikely that any systematic variability in format would impact the results. All other student variables were gathered from partnering district data administrators.

## Measures

Measures included in this study came from the field of psychology and educational science with a history of adequate reliability and validity to measure the constructs of interest for this age group. Measures demonstrated structural and discriminant validity with other related and unrelated constructs in past research with this sample.

### *Divergent Thinking*

DT was measured at each time wave using two sets of divergent thinking tasks—one

verbal and one figural—with three stimuli in each set (Runco, 2011). Four forms of verbal and figural tasks were used, where the first tasks that students responded to at the beginning of Grade 6 (Wave 1) were used again 2.5 years later in the middle of Grade 8 (Wave 5). There was no planned missingness. The verbal tasks followed the AUT protocol that has decades of use in creativity research (Barbot, 2018). Those prompts were more concrete than the abstract figural tasks in that students were given the name of a concrete object, such as *shoelace* or *tire*, and prompted to generate ideas for possible uses—"List as many things you can think of using this object for." In the figural task, a simple, abstract image was provided to students (see Appendix for sample) and students were asked to "look at the figure above—what do you see? List as many things as you can think of that this figure might be." For both the verbal and figural prompts, students were also received the following prompt: "This is NOT a test. This is a game so have fun with it!" Importantly, the DT prompt did not include a "be creative" statement, which some scholars have suggested aligns better to the scoring for creative originality (see Reiter-Palmon et al., 2019). This choice reflected the desire to avoid priming any students' creative anxiety or low creative self-efficacy, unintentionally, with an explicit requirement to be creative. Recent research has demonstrated the existence of creativity-specific anxiety (Daker et al., 2019) and its role in inhibiting individual effort and risk-taking (Anderson et al., 2022). It is possible that this choice in instructions could reduce the overall creative idea generation of the sample; however, it is unlikely that it could change the results because scoring of originality was based on within-sample uniqueness of ideas.

Scoring procedures used a semantics-based algorithmic (SBA) process that recent research demonstrates is efficient and accurate in scoring the originality of responses and comparable to traditional methods for scoring (Acar & Runco, 2019). DT originality has a long

history of valid predictions of creative production and accomplishment (Runco & Acar, 2012). Each response gets analyzed in its entirety within 12 semantic networks but discrete words or phrases within a response are also analyzed to determine association within one category or another. The number of categories produced within a single task is based on the semantic statistic for any pair of ideas in that response, reflecting the semantic similarity between responses. The SBA originality score (SBAIRO) for each response within a task was computed as an average of all semantic association statistics for that idea, adjusted by the idea association frequency rate. The SBAIRO produces a score based on the frequency of occurrence within the sample from which it was drawn (see Beketayev & Runco, 2016 for more explanation). Scoring for originality gave one point for each idea that was observed in less than 10% of the sample and two points for each idea observed in less than five percent of the sample, following the approach of Milgram and Milgram (1976). One figural item from the form used at Wave 1 and Wave 5 (purposefully repeated) demonstrated an issue and was removed; reliability for originality ranged from $\propto$ = .75–.87; Table 1 illustrates sample AUT responses.

A major concern for studying creative development longitudinally is the potential stimulus dependency that could explain how individuals perform differently across time on seemingly interchangeable forms of divergent thinking tasks (Barbot, 2019). If the aim is to estimate the "true change" in demonstrated ability, then the stimulus dependency of scores on alternate forms should be minimal. A major assumption of this study—and similar studies using different divergent thinking stimuli across waves—is that the solution spaces of the three different alternate uses of objects (e.g, many uses of a spoon versus a tire) and the three different figural prompts selected for each wave are more similar and comparable than they are different. To reduce the concern and test that assumption, I inspected the correlation of scores between

each divergent thinking summative score across waves. Additionally, by using the same form in Wave 1 and 5, the potential contribution of stimulus dependency to explain change in ability over time could be assessed. Reported in the Appendix, the correlations between measurement occasions for originality ranged from $r$ = .48-.65 (only one correlation between the form at Wave 3 and Wave 5 was below .50). The correlation for originality at Waves 1 and 5 using the same form fell on the higher end of that range at $r$ = .59—comparable to the correlation between waves when the objects and figural stimuli were different. If the correlation had been much higher between these waves with the same stimuli, then it may have suggested stimulus dependency could be an issue. In sum, stimulus dependency as an explanation for longitudinal change did not appear to be much of a concern for this study.

***Baseline Adaptive Predictors***

Creative ideational confidence was measured using three items from the measure used by Beghetto (2006) to approximate creative self-efficacy of idea generation (e.g., *I am good at coming up with new ideas*) as well as an additional fourth item targeting confidence in the face of social pressure (e.g., *I like my ideas even if others don't*); reliability was $\propto = .72$. Growth mindset was measured with entity belief statements, representing a fixed mindset, modified from a publicly available measure (e.g., *l can learn new things but I can't really change my basic intelligence*) to increase readability for adolescent students (Dweck, 2016). Scores were reversed to create a predictor of greater incremental beliefs of ability; reliability was $\propto = .76$ at Wave 1. Flow in learning was measured with four items (e.g., *Sometimes I get so focused on my work that I forget what I was going to do next*) informed by past measures (Csikszentmihalyi & Rathunde, 1993) and written to be understandable for students; reliability was $\propto = .73$.

***Baseline Maladaptive Predictors***

The Motivation and Engagement Scale – Junior School (MES) (Martin, 2011) measures disengagement as loss of motivation and positive affect toward school by gauging a student's care, interest, and involvement in school; reliability was $\propto = .77$. Anxiety was also measured with three items from the MES; reliability was weaker than the others at $\propto = .66$. Value of conformity was measured using the Runco Attitudes and Values scale (Runco, 2015; e.g., *The important thing in school is to find out what gets other students to like me.*), reliability was $\propto = .71$. Students responded with a 5-point Likert scale.

***Baseline Environmental Predictors***

Students' perception of support for creativity from teachers was measured using a refined version of four items from Runco's Evaluation of the Creative Setting measure (Runco, 2013). That measure demonstrated high reliability and structural validity in past research (Author, 2017d) with reliability of $\propto = .82$ in this study. The other baseline predictor represents the environmental, curricular, and instructional influence of students' exposure to arts integrated teaching and learning across different middle school content areas, provided through a federally funded Arts in Education Model Development and Dissemination project (Anderson & Pitts, 2017). That project used a quasi-experimental non-equivalent comparison group design, where four schools were identified within participating districts to serve as comparison schools based on similar student demographics and academic programming. Students received approximately 25–50 hours of classroom-based visual and theater arts integrated instruction in math, English language arts, social studies, physical education/health, and/or science (Anderson & Pitts, 2017).

***Agentic, Creative, and Academic Outcomes***

Outcomes represented four domains: (a) academic, (b) creative, (c) agentic, (d) and engagement. To measure the academic domains, scores from Smarter Balanced Assessment

Consortium (SBAC) math and English language arts (ELA) tests were used (SBAC, 2016). A summative creativity assessment developed for the arts integration program and measured using the consensual assessment technique provided a domain-specific measure of creative production (Amabile, 1982); inter-rater reliability across three raters was above $\propto = .80$ for all scores (Anderson & Haney, 2021). In addition to a creativity rating of students' visual and written work, the assessment measured their creative self-concept with six items that followed the recommendations from Beghetto and Karwowski (2017); reliability for creative self-concept was $\propto = .90$. Students' sense of personal agency was measured through MES subscales of self-efficacy (four items) and perceived control (four items); reliability was $\propto = .85$. Students' overall affective engagement and participation in school was measured with the MES again.

**Longitudinal Waves of Data and Missing Data**

Following the cohort of students across three middle grades produced a longitudinal dataset described in Table 2 with measurement intervals across the three years. The baseline predictors were measured at Wave 1, outcome measures were measured at Wave 6, and divergent thinking was measured at Waves 1–5. Due to student attrition, which may be higher for the population of students given high rates of mobility and economic insecurity, the rate of missing data was expected to increase over measurement occasions to be as high as 30–40% by Wave 6. Random survey administration problems at a few of the participating schools contributed to an even smaller level of participation at Wave 4 with only scores of 55% of the sample recorded.

Using logistic regression, we expected that identification for Limited English proficiency, free- and reduced-meals eligibility, and special education status would predict missingness, given the role of each of these factors to school mobility and exclusion from educational

experiences. All analyses were conducted with full information maximum likelihood (FIML) where all students would be retained if they had one wave of data. FIML methods can address some issues with missing data by generating parameter estimates and standard error estimates in a single step. Though not without limitations, FIML procedures have demonstrated robust estimation procedures with longitudinal data when data are not missing at random (Graham, 2009).

Complete results of the missing data analyses are available in the Appendix. Results indicated that data were not missing completely at random due to the following three characteristics—limited English proficiency, special education services, and free-reduced eligibility. Therefore, missing at random was a reasonable assumption. Though two of the three variables were included as predictors, parameters could be biased due to this missingness.

**Analytic Strategy**

Latent class growth analysis (LCGA) was conducted using empirical methods of group-based trajectory modeling exemplified in past applications with the Proc Traj program (Nagin, 2005) in SAS software. In contrast to research modeling a single growth curve (Eye & Bogat, 2006), group-based trajectory modeling, or latent class growth analysis, assumes that multiple distinctive developmental trajectories exist and are shaped by specific characteristics. Group-based trajectory modeling tests the assumption that more than one longitudinal function exists, and the multiple functions are different in theoretically and practically meaningful ways.

The first step included data visualization and diagnostic inspection (see Appendix). The next step included identifying the best fitting model with the most substantively meaningful number of trajectory groups. The next step tested the relationship of each predictor on each distinct trajectory class, using the largest normative baseline group as the comparison. During the

class enumeration phase, the influence of those predictors was the primary substantive checking procedure to ensure that a statistical solution formed meaningfully distinct groups (Nylund-Gibson & Choi, 2018). Last, the most likely class membership for each student was used in an analysis of variance (ANOVA) to compare outcomes across trajectory groups.

Analysis followed the procedural guidelines outlined by Jones et al. (2001) to fit models that increase progressively in the number of groups until model fit or meaningfulness of group profiles worsens. The Bayesian Information Criteria (BIC) evaluated model fit empirically, measuring the probability of a correct model compared to another model. The BIC can be a better fit index than others when modeling ignores the nested structure of the data or when interclass correlations are low (Chen et al., 2017). Groups were added until reaching a Bayes factor equaling less than the recommended level of 10 or until solutions produced groups smaller than 1% of the sample. Substantive checking used predictor sets in competing models to learn if the better fitting model with lower BIC produced groups with meaningful differences in theoretically derived predictors. If more of the baseline predictors in Grade 6 were significant in the more parsimonious model, the solution with less groups was chosen even if the BIC was smaller. That decision meant that distinct trajectory patterns in the solution with less groups would be more meaningful beyond statistically derived model fit.

All growth terms up to the fourth-order or quartic term were retained to model the longitudinal patterns for all groups. Procedures and criteria described by Nagin (2005) for determining model adequacy were followed: (a) the average posterior probability for each trajectory group ($AvePP_j > 0.7$); (b) the odds of correct classification for each group ($OCC_j > 5.0$); and (c) an assessment of how close the probability of group assignment is to the proportion of individuals assigned to each group. Models were considered to be adequate if at least two

indices met the threshold. Predictors of membership in a latent class were evaluated using a baseline or normative group for comparison (Nagin, 2005), in this case the largest group. The analysis generated the log odds for the influence of each predictor on the likelihood of membership in each latent trajectory class, relative to the baseline, normative group. Evaluating the influence of hypothesized adaptive, maladaptive, and environmental predictors can improve the trustworthiness of model solutions and advance theory (Nylund-Gibson & Choi, 2018). In the ANOVA outcome comparisons, the most likely group membership assigned to each student was used, following procedures from past research (see Nagin, 2005; Van Ryzin et al., 2009).

## Results

As can be seen in Table 2, the general trends of scores for each factor suggest an initial bump during Grade 6 and then a gradual decline through Grades 7 and 8. However, that bump was not evident in the largest, normative group. Correlations among predictors and each divergent thinking factor at Wave 1 are provided in Table 3, illustrating most of the theorized relationships between environmental, personal, adaptive, and maladaptive characteristics, except for anxiety in school. Based on diagnostic information about the data reported in the Appendix, scores at each wave were positively skewed with outliers evident beyond three standard deviations of the mean.

### Trajectories of Creative Potential in DT Originality

The BIC for originality models continued to improve to an 8-group model but the size of groups became too small to be meaningful in predictor and outcome analyses (< 1.0%). The 6-group model BIC statistics were -10,048.34 ($N$ = 4,416) and -10,026.31 ($N$ = 1,299) compared to -10,077.89 ($N$ = 4,416) and -10,059.54 ($N$ =1,299) for the 5-group solution. The 6-group and 5-group solutions were tested with predictor sets to substantively check the meaningfulness of

solutions. Using the largest normative group as the reference group in the 6-group model, eight environmental, adaptive, and maladaptive predictors demonstrated 10 moments of statistical significance. In contrast, the 5-group model demonstrated 13 moments of statistical significance, indicating a more meaningful representation of distinct trajectory groups. Responding to Research Question 1, those results indicated that the addition of a small sixth group was not meaningful practically or theoretically even though the additional group improved statistical fit of the model—a possible outcome of increasing degrees of freedom with more parameters. As Table 4 illustrates, only one model adequacy diagnostic criterion (the OCC = 4.05 for the largest group) fell just below the threshold, suggesting a good fitting model.

In response to Research Question 1, Figure 2 depicts a trajectory model with 5 distinct groups. The largest group represented 72% of students demonstrating a low amount of originality in their divergent thinking across middle school grades, suggesting a slight decline from $M$ = 2.68 ($SD$ = 1.61) points for originality at the beginning of Grade 6 to $M$ = 2.20 ($SD$ = 1.39) points for originality at the middle of Grade 8. That decrease demonstrated a small effect size of $d$ = 0.32. That group's trajectory was considered the normative pattern. The second largest group of 19% of the sample demonstrated a stable pattern, rising slightly from $M$ = 4.82 ($SD$ = 1.93) points for originality in Grade 6 to $M$ = 5.59 ($SD$ = 2.18) points for originality by the middle of Grade 7 and returning back to $M$ = 4.89 ($SD$ = 2.12) points by the middle of Grade 8—a negligible change overall. The third group of 3% of the sample began at a similar level to Group 2, rising sharply from $M$ = 5.71 ($SD$ = 2.69) and doubling points for their original ideas to $M$ = 11.16 ($SD$ = 1.96) by the end of Grade 6. They demonstrated a declining pattern, ending with $M$ = 3.69 ($SD$ = 1.78) by the middle of Grade 8—a large effect size decrease, $d$ = 0.89.

At 5% of the sample, Group 4 began with $M = 6.86$ ($SD = 2.79$) points for originality in Grade 6 and was the only trajectory to steadily increase original idea production, achieving $M = 10.03$ ($SD = 3.36$) points for originality by the middle of Grade 8. That increase produced a large effect size $d = 1.03$. The 1.5% of the sample in Group 5 began at $M = 10.64$ ($SD = 3.89$) points for originality, rose sharply receiving $M = 15.27$ ($SD = 5.51$) points for originality by the end of Grade 6, then declined gradually back to $M = 8.59$ ($SD = 6.15$) points for originality by the middle of Grade 8. That overall decrease amounted to a small-to-medium effect size, $d = 0.40$.

***Trajectories of Other Divergent Thinking Factors***

That the majority of students demonstrated a decline in divergent thinking originality could be due to an overall increase in cognitive ability, developmentally, for students in the sample, which could make it more difficult for students to generate ideas that would achieve the threshold of uniqueness within the sample (at 10% or 5%) to receive points for originality. By analyzing and describing the trajectory results of divergent thinking fluency (number of ideas), flexibility (number of different conceptual categories of ideas) and composite score of all three factors, we can better determine that the decreasing or static trajectories of most students in this sample were not an artifact of the sample generally producing more ideas (fluency) and/or more categories of ideas (flexibility). A positive trend in fluency and flexibility among most group trajectories identified would suggest the decrease found in originality across a majority of the sample was the result of an overall greater difficulty to find ideas that might be unique across the sample (at the 5% or 10% threshold for rareness). Those two other scores are calculated as a within-person score whereas originality requires the comparison to ideas generated by the rest of the sample. A negative trend in fluency and flexibility would suggest the opposite and validate

the conclusion that the result expresses a decrease in original ideas, generally, not just in relation to the sample. The same interpretation could be made for the divergent thinking composite score.

Group-based trajectory results for those three other scores followed similar patterns to the originality results—detailed figures and results are provided in the Appendix (pages 7–11). For fluency, 87% of students were represented by either a slight decline or statis; for flexibility, 80% of students were represented by a slight decline; for the divergent thinking composite score, 91% of students were represented by a slight decline or statis. Those results suggest that the decline in originality of most students in the sample likely represents a within-student decline in generation of unique divergent thinking ideas, not an overall increase in difficulty of finding unique ideas due to the increasing fluency and flexibility of the sample, in general.

**Predictor Analysis for Originality**

Table 5 illustrates which predictive factors increased the probability of group membership compared to the normative group. The following block entry approach of including predictor sets provided adequate statistical power to control for meaningful demographic variables and to explore statistically significant predictors within sets of related constructs. First, growth parameters in the unconditional model were estimated (Set 1). Second, the log odds parameters for demographic (Set 2) and environmental predictors (Set 3) were generated, while retaining growth parameters. Third, log odds parameters of the adaptive predictors (Set 4) were estimated as a separate predictor set, with Sets 1 and 2 included. Fourth, log odds parameters of the maladaptive predictors (Set 5) were estimated as a separate predictor set with Sets 1 and 2 included.

Compared to the normative *low-gradual decline* Group 1 of originality, students were more likely to be in the *mid-stable* Group 2 if they were female and not in special education and

reported higher levels of support for creativity in their school, flow experiences in learning, growth mindset, creative confidence, lower disengagement, and lower value of conformity early in Grade 6. Students were more likely to be in the *mid-rise-to-decline* Group 3 if they were female and had greater financial resource at home and reported higher levels of flow experiences in learning and lower levels of disengagement. Students were more likely to be in *mid-rise* Group 4 if they were female and had greater financial resources and reported higher levels of flow experiences and growth mindset and lower levels of disengagement and conformity early in Grade 6. The small group of consistently high originality students were more likely to be in *high-rise-to-decline* Group 5 if they were female and held less value of conformity early in Grade 6.

**Outcome Analysis for Originality**

In response to Research Question 3, in most cases, students in the mid and high groups of originality trajectories (Groups 2–5) demonstrated higher levels of personal agency, disengagement, math and ELA achievement, creative production, and creative self-concept detailed in Table 6. Groups 2–5 each had higher means of personal agency than Group 1, ranging from $M = 3.83$ ($SD = 0.74$) for Group 2 to $M = 4.21$ ($SD = 0.66$) for Group 5 with effects sizes ranging from medium ($d = 0.40$) to large ($d = 0.97$). Mean disengagement was lower for students in Groups 4 and 5 than Groups 1–3 with the largest effect size found between Group 1 and 5 at $d = 0.81$, a large effect. Though math and ELA achievement was not different among Groups 2–5, the mean scores for each of those groups was higher than the mean for students in normative Group 1 at medium and large effect sizes. Students in Groups 4 and 5 also demonstrated higher levels of creative production and creative self-concept than students in Groups 1 and 3, which aligns to the prior result that Group 3 had experienced substantial decline in DT originality. The difference between Groups 1 and 5 on creative performance was at a very large effect size, $d =$

1.32. Also, students in Group 2 demonstrated higher creative production and self-concept than Group 1 at a small-to-medium effect size.

**Demographic breakdown.** Table 7 illustrates the demographic makeup of trajectory groups of divergent thinking originality to visualize issues of over- and underrepresentation of specific groups in each latent trajectory class. White students were slightly overrepresented in Groups 2 and 4. Generally, students from racial-ethnic minority groups were not over- or under-represented in normative Group 1. Some specific descriptive statistics are noteworthy. Asian students were overrepresented in the high groups 4 and 5 and multiracial students were highly overrepresented in highly creative Group 5 at 3.5 times the proportion in the sample. Hispanic students were overrepresented in the mid-rise-to-decline Group 3. Though present in Groups 2, 4, and 5, special education students were overrepresented in Group 1 at about 1.25 times their proportion in the sample.

## Discussion

This study represents the first person-centered approach to describe distinct trajectories of creative development during the early adolescent period. The results reinforce the role creative potential plays in healthy adolescent development and contribute several important clarifications to the theoretical model proposed in Figure 1. Results can support future research in this area, especially within the context of socioeconomically marginalized U.S. middle schools.

### Clarifications to the Proposed Model

The normative group of 72% of students demonstrated a gradual decline in DT originality. Compared to that group, the other groups that started Grade 6 higher than that group and sustained higher levels across middle school, generally demonstrated more adaptive characteristics at Grade 6 and more well-rounded preparedness at the end of Grade 8. The two

groups with the highest DT originality by Grade 8—Groups 4 and 5—also showed the highest engagement in school at a statistically significant level. Those groups also showed patterns of higher academic and creative outcomes compared to the other groups, though at non-significant levels, which may have been due in large part to their small sample size. Though a small sample of only $n = 55$ students, Group 4 was the only group to demonstrate consistent growth in DT originality. That group also had some of the highest coefficient estimates for adaptive predictors at Grade 6 when compared to the normative Group 1, such as in a higher flow in learning and growth mindset and lower disengagement and valuing of conformity. Importantly, adaptive Grade 6 predictors and Grade 8 outcomes did not require DT originality growth from Grade 6 to 8. Group 2, who demonstrated statis in DT originality at a level higher than the gradually declining normative Group 1, also demonstrated more adaptive predictors and outcomes. This was the only group whose perceived support for creativity in the school environment at Grade 6 was higher than that for the normative group at a statistically significant level.

Three other results are important additions to the theoretical model. First, Group 4 with the gradual increase in DT originality was the only group of students less likely to be eligible for free-and-reduced lunch compared to Group 1. This result indicates that socioeconomic insecurity may be a detriment to the DT originality growth in adolescence identified by other research (Said-Metwaly et al., 2021); however, socioeconomic privilege may not be necessary to achieve higher levels of DT originality across the middle school years. Second, the students whose DT originality trajectories fit Groups 2-5 were all more likely to be identified as female (based on the gender identification of students in district administrative records). This result indicates that higher levels of DT originality across this early adolescent period was more challenging for male students to achieve, even when accounting for socioeconomic and special education status.

Similarly, Said-Metwaly et al. (2021) found the Grade 7 slump to be more evident for male students. Third, students in Group 2 with relatively static levels of DT originality were the only group less likely to be identified for special education than Group 1. This finding is both the result of a small sample size of special education students across groups and indicates some students with diverse abilities were able to maintain high levels of DT originality across these three years. Each of these results are discussed in more detail below.

**Contributing Factors to the Development of Ideational Originality in Early Adolescence**

A recent meta-analysis of developmental trends in DT originality found a positive trend from Grades 6–8 overall with evidence of a discontinuity, or *slump*, in Grade 7 and a recovery from that slump in Grade 8 (Said-Metwaly et al., 2021). In the results from this current study three of the five groups (or 76% of the sample) demonstrated a decrease at some point in Grade 7; however, those groups, including the large normative group, did not demonstrate a recovery from that dip. Only one group—5% of the sample—demonstrated steady growth. Some part of these results may be attributed to stimulus dependency across data collection waves. Part of that result may be due to the increased challenge students face to generate ideas that will be novel within a sample of students who are all developing greater cognition. However, the group-based trajectory results for fluency and flexibility and inter-wave correlations reduce the likelihood for those two rival explanations. As mentioned previously, this sample had a high concentration of students facing socioeconomic marginalization and the multitude of stressors that accompany poverty. Other research has found socioeconomic disparity to explain differences in creative development during adolescence (Dai et al., 2012).

However, other characteristics stand out that can help inform better understanding of personal and environmental characteristics that might shape growth in DT originality beyond

socioeconomic disparity. Compared to the normative low group, Group 4 students were more likely to experience the heightened concentration and enjoyment of flow in learning and hold a growth-oriented mindset compared to the normative group. They were less likely to ascribe value to social conformity, and they were more likely to be affectively engaged in school. They were also more likely to be identified as female students. Like the other four groups with higher levels of divergent thinking, this group also demonstrated higher academic, agentic, and creative outcomes than their peers in the normative group by Grade 8.

### *Contribution of Gender-Differences*

Rapid physiological development in early adolescence begins earlier for girls than boys (Dahl et al., 2018), which could explain, in part, the overrepresentation of female students in the higher trajectory groups. However, part of that difference could be due to the higher concern for conformity expressed by male students at Grade 6. To partially test that hypothesis, we compared the value of conformity for male ($M$ = 2.35; $SD$ = 0.84) and female ($M$ = 2.02; $SD$ = 0.83) students and found a small-to-medium effect size difference of $d$ = 0.39. The social pressures experienced by young males to conform to ideas about masculinity has come under increasing focus in the past two decades (Connell, 2005; Marasco, 2018). Though speculative, that pressure could be contributing to lower motivation to generate original ideas. Conversely, efforts toward gender equality at the societal level and a creative resilience, specific to adolescent girls, could explain the difference, too (Abraham, 2016). Those results should encourage adult role models in schools to model creative thinking and behavior for both young men and women they mentor.

### *Contribution of School Environments*

The initial low levels and gradual decline in DT originality for the largest group is in contrast to trends from past research (Said-Metwaly et al., 2021) and expectations from

developmental science (Dahl et al., 2018). Gains in knowledge and associative and evaluative skills during that period, potentially peaking in visuo-spatial domain at age 15 (Kleibeuker et al., 2016), suggests that youth in early adolescence should accelerate in DT. Inequitable financial resources at home may explain part of this result, but the generality of this trend across the majority of students may point to school environments that are under pressure to increase test scores—typical in schools serving high proportions of students facing socioeconomic marginalization. Environmental pressures that could stymy creative potential include (a) an academic setting focused on basic skill development alongside curriculum narrowing and reduced learning opportunities in the creative arts (Government Accountability Office, 2009); (b) a push toward teaching for sameness and convergent thinking (Glaveanu & Beghetto, 2017); (c) increased segregation in schools when knowledge about benefits of diversity continues to grow (Graham, 2018); and (d) the less instruction time and higher student to teacher ratio associated with less resourced schools.

Students with more adaptive trajectories of originality had begun middle school with less concern for conformity, a stronger growth mindset, more confidence in ideas, and more frequent experiences of flow in learning. Those conative factors can be shaped by classroom environments. Though the gender differences existed, a higher value of conformity explained different trajectories for both early adolescent girls and boys. Relatedly, development of originality in adolescence was lower in countries emphasizing collectivism and conformity in a recent meta-analysis of developmental trends (Said-Metwaly et al., 2021). Conformity can be thought of as "the tendency to adopt and repeat established norms and behaviors" (Puccio, 2017, p. 331). That gendered socialization has been attributed to negative impacts on creative performance (Baer & Kaufman, 2008) and gendered differences in brain activity related to

creative thinking (Abraham et al., 2014). Blending originality and conformity in thinking is necessary in the creative process to integrate creative ideas into the world (Beghetto, 2017). However, the results from this study indicate that valuing social conformity, specifically, during early adolescence may suppress creative development. As students have shared in their own voices (Anderson et al., 2020), some peers *hide* their creativity. In early adolescence, there appears to be a threshold at which valuing conformity diminishes an individual's creative potential. Valuing conformity less consistently predicted a higher creative trajectory, pointing to one link between DT and identity formation in adolescence (Barbot & Heuser, 2017). Seeking out and committing to a unique set of identities requires breaking from others' norms. Not surprisingly, results from this study linked higher DT originality across middle school to greater creative self-concept.

**Adolescent Creative Development as an Agentic Process**

Personal agency in creativity mediates creative potential to greater creative action in middle school (Karwowski & Beghetto, 2018). Results from this current study illustrate a contrasting picture between conformity and agency—valuing conformity in Grade 6 predicted weaker trajectories of originality and higher levels of originality predicted greater agency at the end of Grade 8. In the model of creative behavior as agentic action (Karwowski & Beghetto, 2018), an individual's latent creative potential becomes creative behavior, in part, through their creative self-beliefs and valuing of creativity, as well as their metacognitive approach to the creative task (Anderson & Haney, 2021). Results reinforce the strength of this model for adolescent development of creative potential. First, creative ideational confidence influenced a higher trajectory. Second, a state of flow is characterized by deep concentration with less interruption of negative self-talk (Csikszentmihalyi & Rathunde, 1993), and flow in everyday

learning predicted a stronger trajectory. Third, valuing social conformity can be considered a polarity force to valuing expression of personal differences and unconventionality. Fourth, a perception of support for creativity in school—a form of proxy agency (Bandura, 2018)—predicted more adaptive creative development for one of the higher groups. In this way, creative potential development in early adolescence may be characterized best as an agentic process. More research about students' extracurricular activities, peer groups, and role models would help fill out this picture.

### *The Importance of Diversity*

Valuing individual differences and diversity stands in contrast to conformity and may influence adolescents' capacity for and value of creative ideation, which can dictate their choice to put effort toward thinking and acting creatively. In the small group of students representing the consistently highest levels of originality, multiracial students were represented at almost four times the level of their proportion in the sample. Though speculative, the diversity of perspectives and experiences and the multiple cultural and racial identities that multiracial students naturally navigate may be a protective factor for their creative potential during adolescence.

### *Creative Potential in Healthy Development*

Findings indicated that creative strengths during the middle school years are likely intertwined with holistic healthy adolescent development. Six decades of research illustrate the overarching benefits of individuals' creative resources across the lifespan to resilience and flourishing (Anderson et al., 2022; Carlsson, 2002; Guilford, 1968; Puccio, 2017; Runco, 1991). The findings of this current study suggest that these creative resources may be powerful during fast-changing adolescence. Students' creative potential during this phase may facilitate their

agency to flexibly create learning conditions that work best for them. Further research can look at how creative potential interacts with students' agentic engagement in learning (Reeve, 2013) to proactively shape their experience in school to be motivationally supportive.

**Implications for Creative Development in School**

The results indicated that exposure to arts integration in half of the schools did not increase the likelihood of students' being classified into higher trajectory groups. There are several reasons to explain this finding. First, students who began Grade 6 with higher levels of originality mostly sustained levels above the normative trend, which indicates that students' opportunities prior to entering middle school played a considerable role. Second, the positive correlation between arts integration treatment and socioeconomic disadvantage ($r$ = .18) and the negative correlation between socioeconomic disadvantage and DT ($r$ = -.10) indicates that any potential effect of arts integration would have needed to overcome that systemic disadvantage. Third, as reported in past research, implementation levels differed between schools with some teachers resisting to the efforts strongly (Anderson, Porter, & Adkins, 2020). Still, results revealed malleable factors undergirding creative potential growth. Educational environments should focus on modeling, metacognition, and messaging in creative learning experiences that contain uncertainty and productive struggle to cultivate multiple dimensions of students' creative resources, such as a growth mindset, confidence, creative ideation, and agentic action (Estabrooks & Couch, 2018).

**Limitations**

As an exploratory study, the study sample represents one region of the country, so generalizing the trajectory patterns beyond this sample should be done with caution. Methodological weaknesses associated with divergent thinking tasks (Barbot, 2018) could result

in patterns that would not replicate with different assessment forms due to stimulus dependency. The flat trajectory of a majority of the sample attenuates some of that concern but it remains relevant. Some of the trajectory groups were as small as 1% of the sample, which greatly limits the statistical power to detect statistically significant effects. Missing data issues in this study highlight the difficulty of conducting longitudinal research in schools with vulnerable student populations, who often face high mobility due to economic hardship. The sample was selected specifically due to reasons for which missingness became more of a problem. Though model fit and adequacy was very good for the model solution and FIML estimation can provide robust estimates, the large amount of missing data could have biased student classification to groups. The results from this study need to be replicated with other samples and different creativity assessments to understand the generalizability of these creative development trajectories.

**Conclusion**

Results from this study illustrates the different factors that contribute to growth in early adolescents' creative potential and the role that growth may play in healthy development. Trajectories of creative potential during this crucial period of human development can take different forms, including patterns of statis, decrease, and growth. Youth in early adolescence can become more original in their ideation, and that potential for growth is dependent, in part, on their value of non-conformity and the agentic qualities of the individual and their environment. As those factors are malleable to modeling, metacognition, and messaging, schools and educators can act to shape students' creative development through adolescence.

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**Figure 1.** Model structure and baseline factors at the onset of adolescence and middle school, which could influence creative growth, stasis, decline, or other developmental patterns.

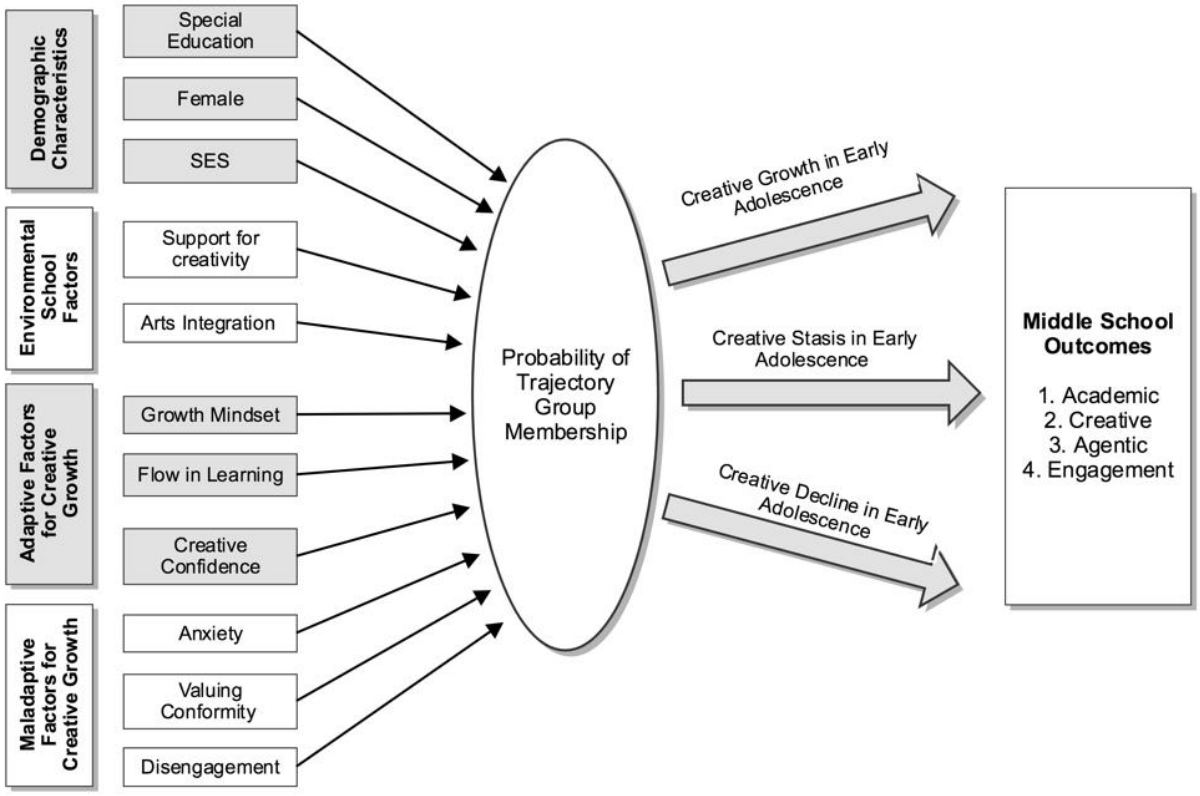

***Figure 2.*** The trajectory patterns for the 5-Group solution (G1–G5) for originality with proportion of sample in each group identified in parentheses as percentages.

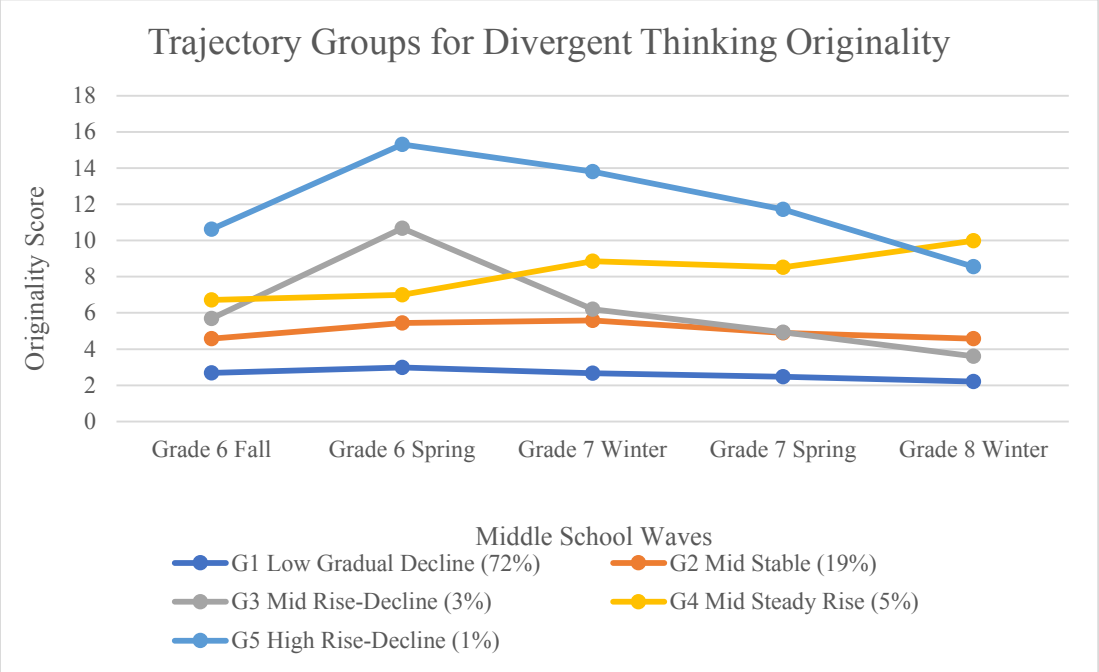


Table 1.

*Divergent Thinking Task Prompts for Many Uses Game and Sample Student Responses*

| Object | Sample Student Responses |
|---|---|
| Shoelace | Bracelet, a belt, sandal design band, to trip someone, handcuffs, cat toy, a rope, to floss your toes, making crafts, to keep sibling out of your room, tie glasses around neck, zipper pull, a fake pet worm, a jump rope for ants, tie to tree to mark places |
| Bowl | Helmet, a speaker, a hard yarmulke, a container, as a template for a bowl haircut, catching falling snow, art utensil holder, fish bowl, transportation device, making music, for a rock display, put water in to make mirror, gold pan, to stop a leak, a trap, plant holder, recycled water fountain |
| Toothbrush | A magic wand, cleaning pets, a floor scrubber, potato masher, a stick, mouse comb, bottle lid cleaner, science experiments, a mini-broom, clean watches, toilet cleaner, pretend microphone, conversation maker, texturizing clay, lip scrubber, to tickle toes, to create friction |

Table 2.

*Waves for Longitudinal Sample (N =1,299) and Mean, Standard Deviation, Range, Cronbach's Alpha, Percent Missing for Divergent Thinking Originality and Outcomes*

| | Grade 6<br>Fall '15<br>Wave 1 | Grade 6<br>Spring '16<br>Wave 2 | Grade 7<br>Winter '17<br>Wave 3 | Grade 7<br>Spring '17<br>Wave 4 | Grade 8<br>Winter '18<br>Wave 5 | Grade 8<br>Spring '18<br>Wave 6 |
|---|---|---|---|---|---|---|
| Originality | 3.86 (2.56)<br>0–20.33<br>∝ = .79 | 4.30 (3.06)<br>0–26.67<br>∝ = .86 | 3.97 (2.96)<br>0–25.67<br>∝ = .87 | 3.67 (2.74)<br>0–25.00<br>∝ = .84 | 3.28 (2.74)<br>0–24.40<br>∝ = .86 | - |
| Sample included in wave | *n* = 1,005 | *n* = 931 | *n* = 911 | *n* = 720 | *n* = 849 | *n* = 849 |
| Percent of full sample | 77% | 72% | 70% | 55% | 66% | 65% |
| Measurement intervals | 0 months | 7 months | 14 months | 19 months | 26 months | 31 months |

Table 3.

*Correlations of Predictor Variables at the Beginning of Grade 6 and Divergent Thinking Originality*

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Female | - | | | | | | | | | | |
| 2. Special ed. | -.10* | - | | | | | | | | | |
| 3. FRL | .05 | .09* | - | | | | | | | | |
| 4. Arts integration | .03 | .01* | .18* | - | | | | | | | |
| 5. Support for cr. | .05 | -.07* | .02 | .02 | - | | | | | | |
| 6. Flow | .11* | -.07* | -.03 | .05 | .48* | - | | | | | |
| 7. Mindset | .07* | -.09* | -.14* | .00 | .03 | .08* | - | | | | |
| 8. Cr. confidence | .04 | -.08* | -.08* | .00 | .28* | .26* | .14* | - | | | |
| 9. Anxiety | .10* | .06 | .03 | -.03 | .05 | .08* | -.19* | -.02* | - | | |
| 10. Disengaged | -.15* | .17* | .03 | .02 | -.37* | -.35* | -.20* | -.16* | .14* | - | |
| 11. Conformity | -.19* | .13* | .04 | .04 | -.13* | -.12* | -.30* | -.14* | .11* | .29* | - |
| 12. DT originality | .25* | -.19* | -.10* | -.02 | .13* | .17* | .13* | .13* | -.04 | -.24* | -.22* |

*Note.* Cr is shorthand for creativity. *$p < .05$.

Table 4.

*Diagnostics of Group-based Model Adequacy for Originality*

| Trajectory Groups | $AvePP_j$ | $OCC_j$ | $Prob_j$ | $Prop_j$ | \|% Dif.\| |
|---|---|---|---|---|---|
| 5 High Rise-to-Decline | .964[a] | 1,807.32[a] | .015 | .014 | 6.5[a] |
| 4 Mid Steady Rise | .821[a] | 90.97[a] | .050 | .046 | 12.4[a] |
| 3 Mid Rise-to-Decline | .803[a] | 93.67[a] | .044 | .029 | 30.5[a] |
| 2 Mid Stable | .736[a] | 10.06[a] | .277 | .190 | 4.2[a] |
| 1 Low Gradual Decline | .895[a] | 4.05 | .678 | .722 | 4.1[a] |

*Note.* Probabilities and proportions are presented to three decimal places. [a]Meets or exceeds criteria presented in Nagin (2005) as evidence for a well-fitting model.

Table 5.

*Model Parameters for 5-Group Solution for Originality Including Demographic, Environmental, Adaptive, and Maladaptive Predictors*

| Set ID | Parameters | Sets Included | Group 1 Low Gradual Decline | Group 2 Mid Stable | Group 3 Mid Rise-to-Decline | Group 4 Mid Steady Rise | Group 5 High Rise-to-Decline |
|---|---|---|---|---|---|---|---|
| | *N* (proportion) | - | 960 (72%) | 253 (19%) | 38 (3%) | 61 (5%) | 18 (1.4%) |
| | Model Term | 1 | | | | | |
| 1 | Intercept | | 2.65**(0.09) | 4.56**(0.23) | 5.68**(0.63) | 6.71**(0.56) | 10.62**(0.52) |
| | Linear | | 1.10* (0.48) | 0.85 (1.13) | 17.96**(4.25) | -3.70 (2.25) | 11.19**(3.01) |
| | Quadratic | | -1.10 (0.61) | 0.33 (1.46) | -18.39**(4.93) | 6.23* (2.96) | -8.72*(3.77) |
| | Cubic | | 0.35 (0.24) | -0.37 (0.59) | 6.10**(1.85) | -2.57* (1.22) | 2.47 (1.53) |
| | Quartic | | -0.04 (0.03) | 0.06 (0.07) | -0.66**(0.22) | 0.32* (0.15) | -0.26 (0.19) |
| | Demographic Predictors | 1, 2, 3 | | | | | |
| 2 | Female | | - | 1.69** (0.27) | 2.62** (0.50) | 1.72**(0.37) | 1.36* (0.54) |
| | Special education | | - | -1.69** (0.52) | -16.53 (1,072)[a] | -2.77 (1.44) | -1.46 (1.06) |
| | FRL | | - | 0.08 (0.26) | -0.87* (0.39) | -0.95**(0.37) | -0.61 (0.54) |
| | Environmental predictors | 1, 2, 3 | | | | | |
| 3 | Arts integration | | - | -0.28 (0.27) | -0.37 (0.38) | -0.73 (0.38) | -0.52 (0.55) |
| | Support for creativity | | - | 0.39* (0.17) | 0.58 (0.31) | 0.25 (0.23) | 0.36 (0.38) |
| | Adaptive predictors | 1, 2, 4 | | | | | |
| 4 | Flow in learning | | - | 0.47**(0.18) | 0.95**(0.30) | 0.82**(0.28) | 0.23 (0.37) |
| | Growth mindset | | - | 0.28* (0.14) | 0.21 (0.19) | 0.46* (0.19) | 0.31 (0.27) |
| | Creative confidence | | - | 0.37* (0.19) | 0.51 (0.30) | -0.10 (0.24) | 0.61 (0.42) |
| | Maladaptive predictors | 1, 2, 5 | | | | | |
| 5 | Anxiety | | - | -0.10 (0.13) | -0.13 (0.19) | -0.31 (0.18) | -0.00 (0.27) |
| | Disengagement | | - | -0.54**(0.16) | -1.34**(0.40) | -0.72* (0.28) | -0.83 (0.45) |
| | Valuing conformity | | - | -0.40* (0.16) | -0.49 (0.25) | -0.55* (0.23) | -0.78* (0.37) |

*Note.* Growth parameters derive from the unconditional model. The intercept estimates Grade 6 starting level; linear term estimates constant change; and the quadratic, cubic, and quartic terms estimate acceleration or deceleration that may occur at different waves. Parameter estimates of predictors represent log odds, compared to Group 1. [a]There were no special education students in this trajectory group. * $p < .05$ and ** $p < .01$.

Table 6.

*Outcome Analyses Results for Originality Trajectory Groups Including Means, Standard Deviations, and Multiple Group Comparisons*

| | Preparedness Outcomes | | | | | |
|---|---|---|---|---|---|---|
| Trajectory Groups | Agency ($N$ = 836) | Disengaged ($N$ = 838) | Math ($N$ = 1,156) | ELA ($N$ = 1,169) | Creative ($N$ = 838) | CSC ($N$ = 845) |
| 1 Low stable | $3.55_{a}$ | $2.60_{a}$ | $2,497.65_{a}$ | $2,530.89_{a}$ | $2.89_{a}$ | $3.14_{a}$ |
| ($n$ = 848) | (0.73) | (1.03) | (187.43) | (168.62) | (1.03) | (0.92) |
| 2 Mid stable | $3.83_{b}$ | $2.39_{a}$ | $2,584.66_{b}$ | $2,606.80_{b}$ | $3.37_{b,c}$ | $3.50_{b,c}$ |
| ($n$ = 215) | (0.74) | (1.01) | (98.21) | (74.37) | (0.96) | (0.79) |
| 3 Mid rise-decline | $3.99_{b}$ | $2.28_{a}$ | $2,593.84_{b}$ | $2,624.84_{b}$ | $2.91_{a,b}$ | $3.04_{a,b}$ |
| ($n$ = 37) | (0.57) | (1.06) | (108.08) | (75.25) | (1.06) | (0.85) |
| 4 Mid stable rising | $3.93_{b}$ | $1.96_{b}$ | $2,629.48_{b}$ | $2,632.29_{b}$ | $3.79_{c}$ | $3.81_{c}$ |
| ($n$ = 55) | (0.69) | (1.03) | (127.94) | (89.47) | (0.85) | (0.79) |
| 5 High rise-decline | $4.21_{b}$ | $1.74_{b}$ | $2,648.29_{b}$ | $2,663.21_{b}$ | $4.08_{c}$ | $4.06_{c}$ |
| ($n$ = 14) | (0.66) | (1.09) | (115.72) | (49.02) | (0.75) | (0.74) |
| Overall means | 3.66 | 2.50 | 2,524.67 | 2,554.18 | 3.06 | 3.27 |
| ($n$ = 1,169) | (0.734) | (1.04) | (174.82) | (153.93) | (1.04) | (0.91) |

*Note.* All estimates reported are of group means for each outcome. Proportion of sample included below each group in the Trajectory Group column represents the sample size with Math and ELA scores for each group. ANOVA omnibus tests were statistically significant at $p < .05$ for all outcomes and trajectory groups. Post hoc pairwise comparisons between trajectory groups used the Bonferroni adjustment (.05/# of comparison) to maintain $p < .05$. Outcome values with different subscripts are significantly different at adjusted $p < .05$.

Table 7.

*Demographic Makeup of Trajectory Groups for Originality and Divergent Thinking Composite (in Percentages)*

| Student Characteristics | Total | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 |
|---|---|---|---|---|---|---|
| Race-ethnicity | | | | | | |
| White | 67.4 | 65.9 | 71.9 | 66.7 | 74.6 | 61.1 |
| Hispanic | 20.0 | 21.6 | 16.1 | 27.8 | 11.9 | 5.6 |
| Multiracial | 8.2 | 8.1 | 7.2 | 5.6 | 8.5 | 27.8 |
| American Indian/Native Alaskan | 1.4 | 1.4 | 2.4 | - | - | - |
| Asian | 1.4 | 1.1 | 2.4 | - | 3.4 | 5.6 |
| Black | 1.1 | 1.5 | - | - | 1.7 | - |
| Pacific Islander | 0.4 | 0.5 | - | - | - | - |
| Female | 47.6 | 41.7 | 63.1 | 63.9 | 64.4 | 61.1 |
| Special education | 15.9 | 19.7 | 8.0 | - | 3.4 | 11.1 |
| Free-reduced meals eligible | 57.6 | 61.7 | 49.8 | 44.4 | 39.0 | 38.9 |