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The Creativity Crisis: The Decrease in Creative Thinking Scores on the Torrance Tests of Creative Thinking

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The *Torrance Tests of Creative Thinking* (TTCT) was developed in 1966 and renormed five times: in 1974, 1984, 1990, 1998, and 2008. The total sample for all six normative samples included 272,599 kindergarten through 12th grade students and adults. Analysis of the normative data showed that creative thinking scores remained static or decreased, starting at sixth grade. Results also indicated that since 1990, even as IQ scores have risen, creative thinking scores have significantly decreased. The decrease for kindergartners through third graders was the most significant.

Research shows that intelligence is increasing (Ceci, 1991; Ceci & Williams, 1997; Dickens & Flynn, 2001). Based on the test norms of the Stanford-Binet and Wechsler tests, Flynn (1984) concluded IQs have increased in the United States over the decades of the last century, which is now called the Flynn effect. Flynn (2007) later concluded IQs have increased worldwide during the past century; IQs on the Raven's Matrices and on the Similarities subtest of the Wechsler Intelligence Scale for Children (WISC) have gained by about 25 points; and IQs on the WISC Arithmetic, Information, and Vocabulary subtests have gained by about 3 points. Flynn (2007) explained the increase in IQs in terms of reduced inbreeding, improved nutrition, or increased affluence around the world.

Contemporaneous with the increase in IQs are increases in the average scores on the Scholastic Assessment Test (SAT, formerly called the Scholastic Aptitude Test). The SAT is one of the most widely used tests for making high-stakes decisions about educational opportunities, placements, and diagnoses. The SAT has traditionally been accepted as a specific aptitude measure to assess verbal and mathematical reasoning abilities, but it has a high correlation with IQ (Frey & Detterman, 2004). SAT average scores decreased in the 1960s and 1970s, and then remained stable with slight increases in the 1980s. Since the 1990s, however, the overall downward trend has been reversed (College Entrance Examination Board, 1993, 2008) and SAT average scores have increased, as IQs have increased.

CHANGES IN CREATIVE THINKING

What of creative thinking? Creativity is distinct from intelligence. Have average levels of creative thinking changed, and if so, have they changed in the same pattern as IQ? The TTCT is a good measure to use when examining changes in the potential for creative thinking over time. That is because it is widely used and psychometrically sound. The TTCT was developed by Torrance in 1966. Although the TTCT has been used primarily as an assessment for the identification of gifted children, Torrance (1966) originally intended to use it as a basis for individualizing instruction for students with any ability level. The TTCT can be administered in either an individual or group testing environment from the level of kindergarten through adulthood. When predicting creative achievement, Kim (2008a) found scores on the TTCT predict ($r = .33$) creative achievement better than other measures of creative or divergent thinking. The TTCT is utilized extensively in both the educational field and the corporate world, and it is more widely used and referenced than other measures of creative or divergent thinking. The TTCT has been translated into over 35 languages (Millar, 2002) and it is utilized worldwide.

I thank Scholastic Testing Services, Inc., for providing access to the raw data sets and for their assistance in clarifying their data.

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The TTCT has two versions, the TTCT-Verbal and the TTCT-Figural, each with two parallel forms, Form A and Form B. It requires 30 minutes to take each form, so speed is important; however, artistic talent is not required to receive credit. The TTCT-Figural consists of three activities, with ten minutes allowed to complete each activity. In Activity I, the subject constructs a picture using a pear or jelly bean shape provided on the page as a stimulus. The stimulus must be an integral part of the picture construction. Activity II requires the subject to use ten incomplete figures to make an object or picture. The last activity, Activity III, is composed of three pages of lines or circles which the subject is to use in creating a picture or pictures (Kim, 2006). For the purposes of this article, only the TTCT-Figural will be considered in detail.

What the TTCT-Figural Measures

The TTCT-Figural has remained unchanged but was renormed with each edition of the TTCT manual. The only significant change to the test was revision of scoring procedures in the third edition of the scoring manual in 1984. The current form of the TTCT-Figural includes scores for: Fluency, Originality, Elaboration, Abstractness of Titles (Titles), Resistance to Premature Closure (Closure), and 13 creative personality traits that comprise the Creative Strengths (Strengths) Subscale (see Kim, 2006, for details). The TTCT-Figural has been found to be fair in terms of gender, race, community status, language background, socioeconomic status, and culture (Cramond, 1993; Torrance, 1971; Torrance & Torrance, 1972).

Torrance (1976; Torrance & Safter, 1986) examined changes over time. He reported Fluency, Originality, and Elaboration scores on the TTCT-Figural increased from 1967 ($n = 91$) to 1976 ($n = 108$) and from 1976 ($n = 17{,}361$) to 1982 ($n = 10{,}957$). Torrance (1976) included small samples of only fifth graders from 1967 to 1976. Torrance and Safter (1986) included larger samples and represented 31 states from first graders through college students from 1976 to 1982. However, given the small sample sizes for Torrance's (1976) comparisons in TTCT scores between 1967 and 1976, and the restriction of the sample to only include fifth graders, the increase in creative thinking scores from 1967 to 1976 cannot be generalized.

The Scholastic Testing Service, which owns the copyright of the TTCT, reported in the 1998 TTCT manual that the scores from the 1998 norm-base are comparable overall to those from the 1990 norm-base. The company reported in the 2008 TTCT manual that the scores from the 2008 norm-base decreased since those from the 1998 norm-base. However, these reports are based on the standard scores and the overall composite scores of the TTCT. In addition, the changes in the scoring procedures for the TTCT were not considered, and thus comparisons of the changes among different normative samples of the TTCT are inaccurate. The use of the standard scores is inappropriate because the standard scores have already been adjusted by the samples' performance for each of the six TTCT norms. Thus, because valid comparisons cannot be made using standard scores, raw subscale scores were analyzed in this study. Additionally, Torrance (1979) discouraged interpretation of scores as a total score or a static measure of a person's ability and warned using a composite score may be misleading because each subscale score has independent meaning. Instead, Torrance encouraged the interpretation of subscale scores separately and use of the profile of strengths and weaknesses as a means to understand and nurture a person's creativity.

Changes over time may be related to developmental changes in creative thinking. Such developmental changes were described by Vygotsky (1987, 1990, 1994; see Smolucha, 1992) and Piaget (1950) and are apparent in fairly recent empirical research. Smith and Carlsson (1983), for example, concluded children are not creative in the true sense of creativity before age 10–11 (grades 5–6) because they lack the required cognitive sophistication. They argued that children younger than this age are dependent on accidental impressions and more focused on material incorporated into their private self; therefore, their attempts for creative activity might be premature and accidental. Smith and Carlsson (1983) also found high anxiety and creativity in 10–11-year-olds, and then an increase in compulsive and compulsive-like strategies in 12–13-year-olds (Grades 7–8) accompanied by a decrease in creativity. Further, Smith and Carlsson (1985) found adolescents' creativity starts a slow increase at age 14 (Grade 9), as they develop better anxiety control and learn to be more flexible by age 16. The period of anxiety and confusion reaches a balance between internal and external by age 16 (Grade 11) so that anxiety is better controlled by flexible adult strategies and self-reliance is restored (Smith & Carlsson, 1985).

Gardner (1982) indicated preschool children have high levels of creative ability, and when they enter school, their artistic creativity tends to decline as they learn conformity, but begins increasing during preadolescence (Grades 5–8) and continues though adulthood. Some studies indicated a child's creativity slumps around ages 8–9, in fourth grade, the so-called fourth-grade slump. Axtell (1966) detected a decline at the fourth grade in the curiosity of gifted students. Soon after Torrance (1967) identified a more general slump in creativity in the fourth grade, and then subsequently increases. Many studies have concluded a large drop in creativity and curiosity occurs when socialization and conformity is initially taught, which in Western society begins in the fourth grade (Axtell, 1966; Kang, 1989; Marcon, 1995; Nash, 1974; Timmel, 2001;

Torrance, 1977; Williams, 1976). Torrance (1977) suggested these decreases occur when children in Western cultures are confronted with new stresses and demands and are expected to conform to classroom etiquette and peer pressure, and thus their creative abilities are discouraged. After the fourth and fifth grades, creativity scores reportedly increase (Torrance, 1967).

The fourth-grade slump has also been seen in other cultures, including with Cuban students who emigrated to the United States (Timmel, 2001) and Korean students (Kang, 1989). Georgsdottir and Lubart (2003) found both cognitive flexibility and creativity decreased among French students. Torrance (1967) reported the existence of the fourth-grade slump in seven different cultures: an advantaged Caucasian student subculture in the United States, a disadvantaged African American student subculture in the United States, West German, Australian, Norwegian, Indian, and Western Samoan. However, these results show some variation in the timing of the slump because in some cultures a drop in creativity occurs at the end of the third grade or the beginning of the fourth grade, whereas in some cultures a drop does not occur until the sixth grade. Further, the existence of a fourth grade slump is disputed because some studies have reported contrary findings. Claxton, Pannells, and Rhoads (2005) found a slight increase in divergent-thinking scores between fourth and fifth grade. Charles and Runco (2001) reported a peak at fourth grade. Sak and Maker (2006) reported no peaks or slumps at the fourth grade.

The objective of the present research was to address the question of possible changes in creativity thinking that have occurred over the last 40 years, using the large amount of data that is available in the norms of the TTCT. This data set allowed the most extensive analysis yet of changes over time. How has creative thinking changed over the last 40 years? Is there a difference in the changes by different age groups?

METHOD

Data

The data sets for the normative samples for the TTCT-Figural were obtained through the Scholastic Testing Service, Inc. (STS). The TTCT-Verbal is not an interest of this study because it measures mostly divergent thinking, whereas TTCT-Figural measures more than divergent thinking and is used eight to 10 times more than TTCT-Verbal.

The TTCT was developed in 1966 ($n = 3{,}150$) and has been renormed five times: in 1974 ($n = 19{,}111$), 1984 ($n = 37{,}814$), 1990 ($n = 88{,}355$), 1998 ($n = 54{,}151$), and in 2008 ($n = 70{,}018$). The 1966 TTCT sample that is available does not include kindergartners, and the 1998 TTCT sample did not include adults, but the other four editions included both kindergarten and adults. All six normative samples used for the present study included 272,599 kindergarten through 12th grade students and adults. It is a geographically balanced sample that covers areas that encompass the Central, Northeast, Southeast, and Western regions in the United States. No information of sampling procedures including relevant demographics was reported by the STS, in part to ensure anonymity because the STS does not publicize demographic data from examinees.

Use of the Subscale Scores of the TTCT

The stimuli on the TTCT have not changed from the original 1966 test to date, despite the repeated renorming of the tests. However, the scoring procedures for all subscales, except Fluency, were changed for the 1984 TTCT. The 1984 TTCT scoring procedures are the same as current scoring procedures in use today. Thus, for the present study, Fluency scores were compared from the 1966 TTCT through the 2008 TTCT; Originality and Elaboration scores were compared from 1966 to 1974, and separately from 1984 through 2008; Strengths scores were compared from 1990 through 2008; and Titles and Closure scores were compared from 1984 through 2008. The means and standard deviations of the 1966 through 1984 TTCT scores were obtained from the norming manuals, and those from the 1990 through 2008 TTCT scores were obtained from the actual data sets as well as the norming manuals. Pooled means and pooled standard deviations were calculated between the TTCT-Figural Forms A and B.

RESULTS

How Does Creative Thinking Change With Age?

To examine a difference in subscale scores of the TTCT between a year and its previous year as well as between age groups, independent sample t-tests were conducted. In addition, to explain the amount of increase or decrease of the scores, effect sizes were reported. For statistical significance tests, considering the large sample sizes of the normative groups and multiple tests (62) of statistical significance on the same data of the present study, a conservative statistical criterion ($p < .001$) was used to protect against Type I error.

Fluency. The total Fluency scores for Years 1966, 1974, 1984, 1990, 1998, and 2008 increased up to third grade and remained static at fourth grade, $t(78{,}740) = 2.33$, $p = .020$, and fifth grades, $t(62{,}672) =$

0.48, $p = .629$, as Figure 1 shows. Fluency scores significantly decreased starting at sixth grade, $t(51,903) = 7.15$, $p < .001$, through adults.

Originality. The total Originality scores for Years 1984, 1990, 1998, and 2008 increased thorough fifth grade and significantly decreased starting at sixth grade, $t(44,612) = 9.94$, $p < .001$, as Figure 1 shows. Originality scores increased for adults, but the increase was not significant, $t(19,151) = 1.01$, $p = .310$.

Elaboration. The total Elaboration scores for Years 1984, 1990, 1998, and 2008 increased up to fifth grade and remained static at sixth grade, $t(44,612) = 2.62$, $p = .009$, as Figure 1 shows. Elaboration scores significantly increased during seventh and eighth grades, $t(36,664) = 12.37$, $p < .001$, and increased in high school, but the increase was not significant, $t(29,475) = 0.97$, $p = .333$. Elaboration scores significantly decreased in adults, $t(15,602) = 28.46$, $p < .001$.

Abstractness of titles. The total Titles scores for Years 1984, 1990, 1998, and 2008 increased up to fifth grade, remained static in sixth grade, $t(36,664) = 3.40$, $p = .043$, seventh and eighth grades, $t(44,612) = 2.02$, $p = .001$, and high school, $t(29,475) = 1.12$, $p = .001$, as Figure 1 shows. Titles scores significantly increased in adults, $t(15,602) = 14.84$, $p < .001$.

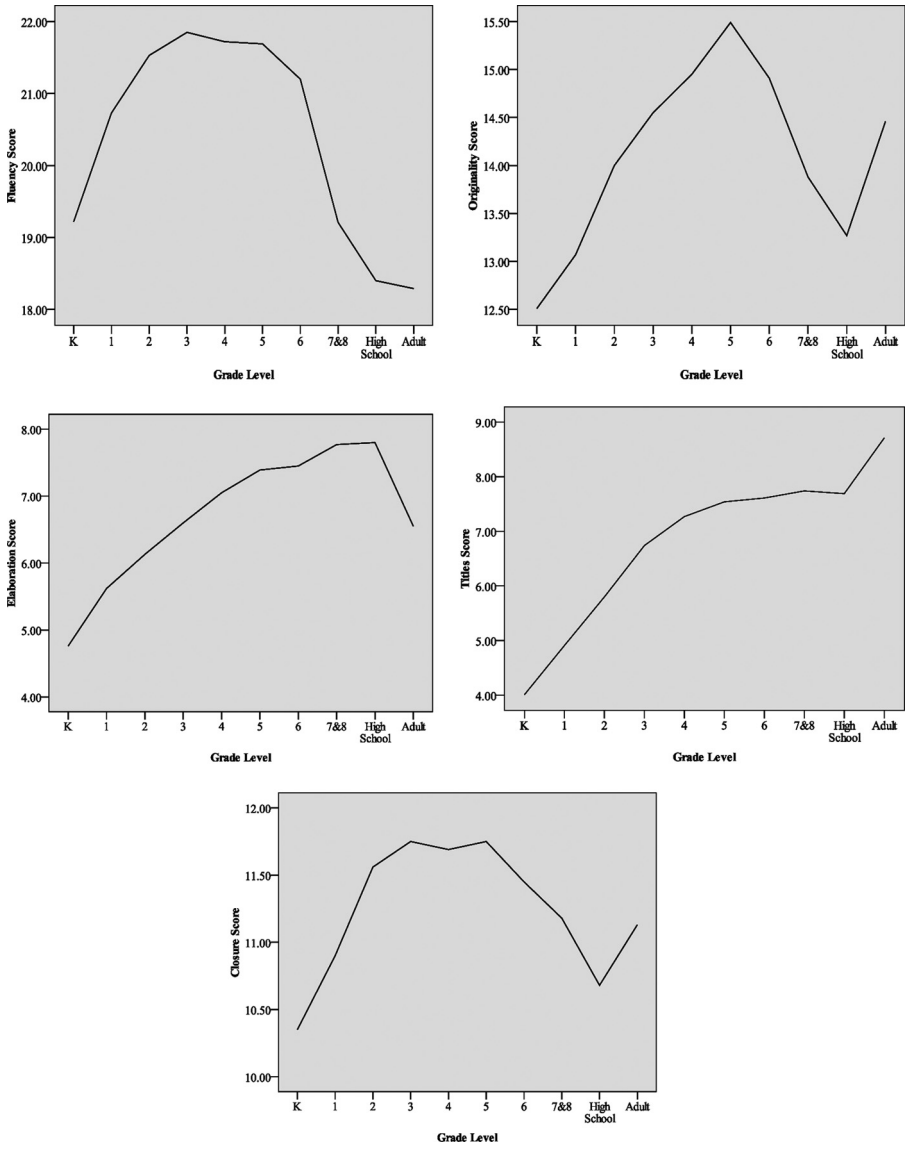

FIGURE 1 Total Fluency, Originality, Elaboration, Abstractness of Titles, and Resistance to Premature Closure scores for Years 1966, 1974, 1984, 1990, 1998, and 2008 by grade level.

Resistance to premature closure. The total Closure scores for Years 1984, 1990, 1998, and 2008 increased up to third grade, and remained static in fourth grade, $t(56{,}805) = 1.81$, $p = .043$, and fifth grade, $t(73{,}096) = 2.02$, $p = .070$, as Figure 1 shows. Closure scores significantly decreased in sixth grade, $t(44{,}612) = 8.09$, $p < .001$, seventh and eighth grades, $t(36{,}664) = 6.59$, $p < .001$, and high school, $t(29{,}475) = 10.37$, $p < .001$. Closure scores significantly increased in adults, $t(15{,}602) = 6.47$, $p < .001$.

How Has Creative Thinking Changed Over the Last 40 Years?

Fluency. Fluency scores decreased from 1966 to 1974, increased from 1974 to 1990, but decreased from 1990 to 2008, as Figure 2 shows. The decrease in Fluency scores from 1966 to 1974 was significant, $t(22{,}259) = 10.24$, $p < .001$, $d = 0.20$ (small to moderate effect). The increase in Fluency scores from 1974 to 1984 was significant, $t(56{,}923) = 7.38$, $p < .001$, $d = -0.07$ (small effect). The increase in Fluency scores from 1984 to 1990 was significant, $t(126{,}167) = 8.54$, $p < .001$, $d = -0.05$ (small effect). The decrease in Fluency scores from 1990 to 1998 was significant, $t(142504) = 23.81$, $p < .001$, $d = 0.13$ (small to moderate effect). The decrease in Fluency scores from 1998 to 2008 was significant, $t(124{,}167) = 11.10$, $p < .001$, $d = 0.06$ (small effect).

To compare between age groups, five categories were created: Kindergartners though third graders, fourth through six graders, seventh and eighth graders, high school students, and adults. The decreases in Fluency scores from 1990 to 2008 were examined separately for the five different age groups. The largest decrease in Fluency scores from 1990 to 2008 was for kindergartners through third graders, $t(92{,}931) = 48.56$, $p < .001$, $d = 0.32$ (moderate effect). The second largest decrease in Fluency scores was for fourth through sixth graders, $t(45{,}732) = 17.37$, $p < .001$, $d = 0.17$ (small to moderate effect). The decrease in Fluency scores for high school students was not significant at .001, $t(6{,}193) = 2.79$, $p = .005$. Contrarily, Fluency scores for seventh and eighth graders increased, but the increase was not significant, $t(10{,}081) = 2.22$, $p = .026$. Fluency scores for adults also increased, but the increase was not significant, $t(3{,}426) = 1.71$, $p = .087$.

Originality. Originality scores increased from 1966 to 1974, but decreased from 1990 to 1998 and remained

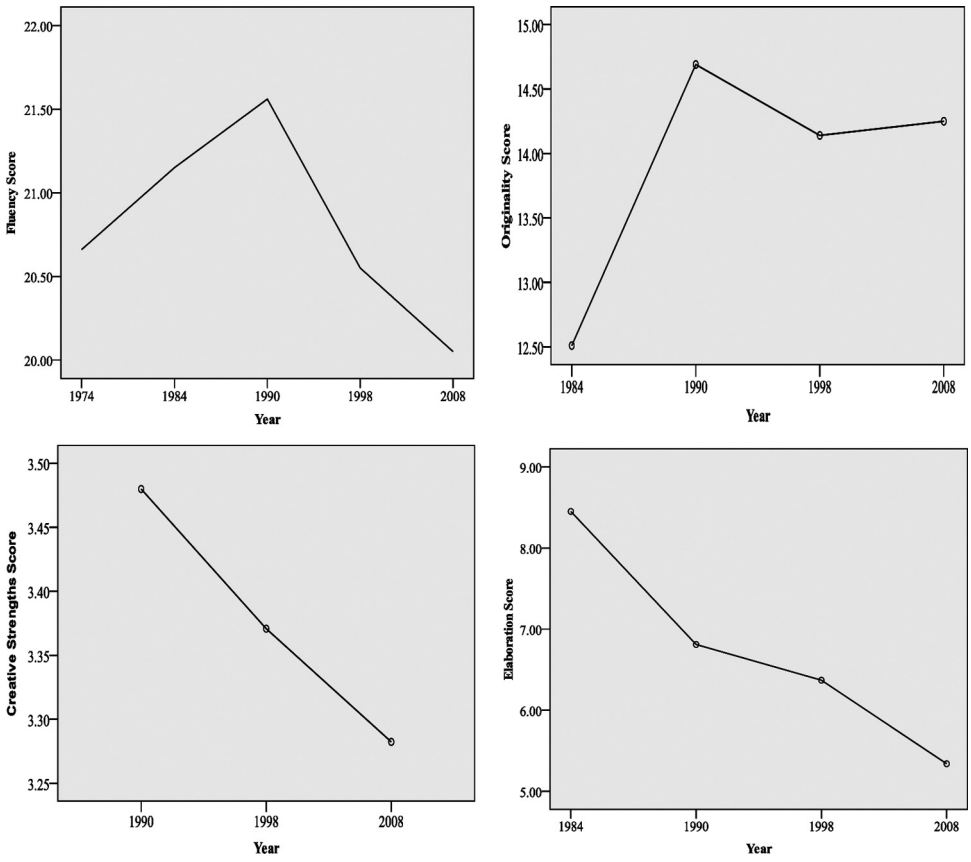

FIGURE 2 Fluency, Originality, Creative Strengths, and Elaboration scores for Years 1974, 1984, 1990, 1998, and 2008.

static from 1998 to 2008, as Figure 2 shows. From 1966 to 1974, the increase was significant, $t(22,259) = 11.08$, $p < .001$, $d = -0.22$ (small to moderate effect). From 1990 to 1998, the decrease was significant, $t(142,504) = 16.85$, $p < .001$, $d = 0.09$ (small effect). From 1998 to 2008, Originality scores increased very slightly, but the difference was not significant at .001, $t(124,167) = 3.20$, $p > .001$.

The decreases in Originality scores from 1990 to 2008 were examined for the five different age groups separately. The largest decrease in Originality scores from 1990 to 2008 was for kindergartners through third graders, $t(92,931) = 10.31$, $p < .001$, $d = 0.07$ (small effect). The second largest decrease was for fourth through sixth graders, but it was not significant at .001, $t(45,732) = 3.18$, $p = .002$. The decrease in Originality scores for high school students was not significant, $t(6,193) = 1.40$, $p = .160$. Originality scores for seventh and eighth graders significantly increased, $t(10,081) = 7.07$, $p < .001$, $d = -0.15$ (small to moderate effect). Originality scores for adults also increased, but the increase was not significant at .001, $t(3,426) = 3.08$, $p = .002$.

Creative strengths. Strengths scores decreased from 1990 to 2008, as Figure 2 shows. From 1990 to 1998, the decrease was significant, $t(36,527) = 4.36$, $p < .001$, $d = 0.05$ (small effect). From 1998 to 2008, the decrease was significant, $t(50,129) = 4.26$, $p < .001$, $d = 0.04$ (small effect). Strengths was the only criterion-referenced subscale of the TTCT and grade levels for the subscale were not available, therefore no age group analysis was conducted.

Elaboration. Elaboration scores increased from 1966 to 1974, but decreased from 1984 to 2008, as Figure 2 shows. From 1966 to 1974, the increase was significant, $t(22,259) = 20.33$, $p < .001$, $d = -0.42$ (moderate to large effect). From 1984 to 1990, the decrease was significant, $t(126,167) = 106.14$, $p < .001$, $d = 0.62$ (large effect). From 199 0 to 1998, the decrease was significant, $t(142,504) = 37.21$, $p < .001$, $d = 0.21$ (small to moderate effect). From 1998 to 2008, the decrease was significant, $t(124,167) = 103.20$, $p < .001$, $d = 0.59$ (large effect).

The decreases in Elaboration scores from 1984 to 2008 were examined for the five different age groups separately. The largest decrease in Elaboration scores from 1984 to 2008 was for adults, $t(1,564) = 27.88$, $p < .001$, $d = 1.54$ (large effect). The second largest decrease in Elaboration scores was for kindergartners through third graders, $t(63,122) = 150.71$, $p < .001$, $d = 1.23$ (large effect). The third largest decrease in Elaboration scores was for high school students, $t(3,956) = 24.71$, $p < .001$, $d = 1.18$ (large effect). The decrease in Elaboration scores for seventh and eighth graders was significant, $t(8,001) = 43.54$, $p < .001$, $d = 1.06$ (large effect). The decrease in Elaboration scores for fourth through sixth graders was significant, $t(31,179) = 92.64$, $p < .001$, $d = 1.03$ (large effect). Thus, the decreases in Elaboration scores for all five age groups were significant with large effect sizes.

Abstractness of titles. Titles scores increased until 1998, but decreased from 1998 to 2008, as Table 1 shows. From 1984 to 1990, the increase in Titles scores was significant, $t(126,167) = 33.78$, $p < .001$, $d = -0.20$ (small to moderate effect). From 1990 to 1998, the increase in Titles scores was significant, $t(142,504) = 49.28$, $p < .001$, $d = -0.27$ (small to moderate effect). From 1998 to 2008, however, the decrease in Titles scores was significant, $t(124,167) = 24.82$, $p < .001$, $d = 0.14$ (small to moderate effect).

The decreases in Titles scores from 1998 to 2008 were examined for the four different age groups separately. Adults were excluded from this analysis because adults were not included in the normative sample in 1998.

TABLE 1
Means and Standard Deviations of the Subscale Scores on the TTCT for Years 1966, 1974, 1984, 1990, 1998, and 2008 (N = 272, 599)

TTCT Year	*Fluency M(SD)*	*Originality M(SD)*	*Strengths M(SD)*	*Elaboration M(SD)*	*Titles M(SD)*	*Closure M(SD)*
1966	22.04 (7.00)	26.82 (10.38)	–	60.40 (24.22)	–	–
1974	20.66* (7.01)	29.15* (11.02)	–	71.56* (29.20)	–	–
1984	21.15 (7.71)	12.51 (5.41)	–	8.45 (2.90)	5.50 (3.58)	10.97 (4.39)
1990	21.56* (7.86)	14.69* (6.11)	3.48 (1.98)	6.81* (2.33)	6.21* (3.35)	9.99* (3.75)
1998	20.55* (7.63)	14.14* (5.76)	3.37* (2.74)	6.37* (1.87)	7.15* (3.72)	12.52* (4.01)
2008	20.05* (8.05)	14.25 (6.20)	3.28* (1.75)	5.34* (1.64)	6.62* (3.74)	12.29* (4.43)

Note. Titles = Abstractness of Titles; Closure = Resistance to Premature Closure; Strengths = Creative Strengths.

*$p < .001$ when compared to the mean of the previous year.

The sample size ($N = 60,757$) for the Creative Strengths scores is based on $n = 12,541$ (1990), $n = 23,988$ (1998), and $n = 26143$ (2008), due to missing values.

The largest decrease in Titles scores from 1998 to 2008 was for kindergartners through third graders, $t(82,972) = 19.31$, $p < .001$, $d = 0.14$ (small to moderate effect). The decrease in Titles scores for high school students was not significant, $t(2,453) = 1.87$, $p = .062$. The decrease in Titles scores for seventh and eighth graders was not significant, $t(6,217) = 2.03$, $p = .042$. Contrarily, Titles scores for fourth through sixth graders increased slightly, but the increase was not significant, $t(31,937) = 0.48$, $p = .633$.

Resistance to premature closure. Closure scores decreased from 1984 to 1990, increased from 1990 to 1998, but decreased again from 1998 to 2008, as Table 1 shows. From 1984 to 1990, the decrease in Closure scores was significant, $t(126,167) = 40.35$, $p < .001$, $d = 0.24$ (small to moderate effect). From 1990 to 1998, the increase in Closure scores was significant, $t(142,504) = 120.38$, $p < .001$, $d = -0.65$ (large effect). From 1998 to 2008, however, the decrease in Closure scores was significant, $t(124,167) = 9.45$, $p < .001$, $d = 0.05$ (small effect).

The decreases in Closure scores from 1998 to 2008 were examined for the four different age groups separately. The largest decrease in Closure scores from 1998 to 2008 was for kindergartners through third graders, $t(82,972) = 12.86$, $p < .001$, $d = 0.09$ (small effect). Closure scores for fourth through sixth graders significantly increased, $t(31,937) = 4.06$, $p = .633$, $p < .001$, $d = -0.05$ (small effect). Closure scores for seventh and eighth graders increased, but the increase was not significant, $t(6,217) = 1.73$, $p = .083$. Closure scores for high school students increased, but the increase was not significant, $t(2,453) = 0.28$, $p = .782$.

DISCUSSION

Change in Creative Thinking With Age

Children's ability to produce ideas (Fluency) increased up to third grade and remained static between fourth and fifth grades, and then continuously decreased, which might indicate children become alert to issues like accuracy and appropriateness of their responses when they generate ideas. During middle childhood, children are more concerned about representational accuracy rather than aesthetic appeal itself (Rosenblatt & Winner, 1988). Increases in preference for appropriate ideas and in *evaluative thinking* are related to decreases in divergent thinking (Charles & Runco, 2001; Runco, 2003).

Children's ability to think in a detailed and reflective manner as well as their motivation to be creative (Elaboration) increased steadily until high school, when it is static, and then decreases in adulthood. This may indicate children are increasingly willing to elaborate and are rewarded for it through their school years, and the rewards for elaboration decreased after graduation, and elaboration may distract from post–high school pursuits. This is true only for the general adult population, and not for all adults. For eminent creative adults, elaboration increases with age. Simonton (1983) suggested eminent creative adults generate a lot of ideas in their earlier careers, but later they focus on elaboration of their ideas, and creative productivity increases as elaboration increases. Thus, creative productivity for eminent creators does not decrease with age but increases with age and level of elaboration.

Children's abstract thinking ability and ability for synthesis and organization thinking processes and for capturing the essence of the information involved (Abstractness of Titles) increased through a lifetime. This may indicate individuals steadily build and develop tools and abilities for abstract thinking. This is consistent with Vygotsky's (1990, 1994) conclusions that individuals' abstract thinking develop with age, and imagination and abstract thinking are completely integrated with each other in adulthood so that creative imagination can be transformed into creative products (Vygotsky, 1994).

Children's ability to produce unique and unusual ideas (Originality) increased up to fifth grade, decreased through high school, and then increased in adulthood. Children's ability to be intellectually curious and to be open-minded (Resistance to Premature Closure) followed a similar path. Until fifth grade, children were increasingly open-minded and curious and more apt to produce unique responses. After that, they began a trend of increasing conformist thinking that continued through high school. This may reflect an influence toward conformity in middle and high schools. Children might be losing the ability to generate original ideas due to the effects of Kolberg's conventional thinking stage, when they experience the pressure of conventionality (Runco, 2007). However, this is inconsistent with Piaget (1950) in that adolescents' divergent feeling expressions increase as abstract thinking ability increases; inconsistent with Smith and Carlsson (1985) in that adolescents' creativity starts a slow increase starting at age 14, as they develop better anxiety control and learn to be more flexible by age 16; and inconsistent with Gardner (1982) in that creativity increases during preadolescence and continues though adulthood.

The results indicate creative thinking scores decreased or remained static at sixth grade, suggesting a sixth-grade slump, instead of the well-known fourth-grade slump. Some cause or set of conditions present in sixth grade typically affect all aspects of creative thinking. The development of logical thinking and reasoning ability might be related to losing creative

thinking (e.g., Lubart & Lautrey, 1996). According to Piaget (1981), assimilation process in a spontaneity state is creative imagination, and creative imagination does not decrease with age. However, as creative imagination is reintegrated in intelligence, due to the accommodation process, creative imagination is compromised (Piaget, 1981).

Decreased Creative Thinking in the Past 20 Years

Fluency scores decreased from 1990 to 2008. The largest decrease in Fluency scores from 1990 to 2008 was for kindergartners through third graders, and the second largest decrease was for fourth through sixth graders. This indicates younger children's (kindergartners through sixth graders) ability to produce many ideas significantly decreased after 1990.

Originality scores increased until 1990, but decreased from 1990 to 1998, and remained static from 1998 to 2008. Originality is the only TTCT subscale that is reflective of culture and time. Torrance (1988) suggested the originality lists used for scoring the TTCT be culturally specific and updated over time. Thus, Kim (2006) questioned the credibility of Originality scores of the 1998 TTCT, because the scores were based on the lists of responses that are statistically common developed by Torrance in 1984, over 14 years earlier. Kim argued the frequency of different responses should change with culture and time. Originality is known to be culture-specific and the creation and use of independent criteria for each group is warranted (Kim, 2004, 2009; Millar, 1995; Saeki, Fan, & Van Dusen, 2001). The statistical frequency of various responses will vary among people over time and in different cultures. Any error due to changes over time and culture were further compounded because the 1984 Originality Lists were also used for the normative samples of the 2008 TTCT.

For example: Activity III of the TTCT-Form A consists of parallel lines. Computers, iPods, cell phones, and other gadgetry may be common responses in 2011, but they were rare and fanciful in 1984 and are not included on the 1984 Originality Lists still in use today. Thus, a TTCT test subject in 2011 scores Originality points by responding with drawings that would be considered common responses, were the lists updated. The continued use of 1984 Originality Lists leads to an expectation that the Originality scores should increase more, the longer the Originality Lists are not updated, and to the extent it does, the Originality scores are inflated. While the results indicate Originality scores decreased from 1990 to 1998 and remained static from 1998 to 2008, these scores should be considered inflated, by virtue of the TTCT using outdated Originality lists. Kindergartners through third graders suffered the largest decrease in Originality scores from 1990 to 2008. Although the decrease in Originality scores for fourth through sixth graders was not significant, Originality scores would have been artificially inflated due to use of the 1984 Originality Lists, and the decrease in Originality scores for younger children (kindergartners through sixth graders) is likely larger than the results suggest. Thus, it can be concluded younger children's ability to produce statistically infrequent, unique, and unusual ideas has significantly decreased after 1990.

The significant decrease of Strengths scores since 1990 indicates that over the last 20 years, children have become less emotionally expressive, less energetic, less talkative and verbally expressive, less humorous, less imaginative, less unconventional, less lively and passionate, less perceptive, less apt to connect seemingly irrelevant things, less synthesizing, and less likely to see things from a different angle. It could be speculated children are learning to interact in more impersonal ways, as they are more dependent on current technologies to communicate, perhaps because these technologies lack person to person, verbal and other interpersonal communicative signals. Technologies can enhance creativity and are useful tools for the creative process; however, some aspects of technologies may hinder the development of a child's creative personality.

The decrease in Elaboration scores which persists since 1984 indicates that over the last 30 years, 1) people of all ages, kindergartners through adults, have been steadily losing their ability to elaborate upon ideas and detailed and reflective thinking; 2) people are less motivated to be creative; and 3) creativity is less encouraged by home, school, and society overall.

Abstractedness of Titles scores decreased beginning in 1998, a little later than the decreases of other TTCT subscales, which began in 1984 (Elaboration) and 1990 (Fluency, Originality, and Strengths). Because Titles scores have a positive relationship with verbal intelligence scores, and because verbal intelligence scores have increased throughout the same period, Titles scores would have been expected to increase. The effect of the increase in verbal intelligence may have counterbalanced diminished abstractive thinking abilities also measured by Title scores. The results indicate younger children are becoming less capable of the critical thinking processes of synthesis and organization and less capable of capturing the essence of problems.

Closure scores decreased from 1998 to 2008. Because Closure scores have a strong positive relationship with intelligence, and because intelligence has increased, Closure scores would have been expected to increase as well; however, the increase in intelligence may have counterbalanced diminished cognitive abilities also measured by Closure scores. The results indicate younger children are tending to grow up more narrow-minded, less intellectually curious, and less open to new experiences.

IMPLICATIONS

The results indicate creative thinking is declining over time among Americans of all ages, especially in kindergarten through third grade. The decline is steady and persistent, from 1990 to present, and ranges across the various components tested by the TTCT. The decline begins in young children, which is especially concerning as it stunts abilities which are supposed to mature over a lifetime.

The decrease of creative thinking for younger children probably arises at home rather than in schools, because kindergarteners and first graders tend to be influenced more by home than school, or possibly both environments contribute to the effect. Regardless, something changed or has been changing to result in the decline of creative thinking in the United States over time, especially affecting younger children.

Efforts to encourage creativity should begin in preschool or before. Harrington, Block, and Block's (1987) longitudinal study found children whose parents provided psychological safety and freedom developed creative potential in adolescence more fully than other children, seven to 11 years after implementing Rogers' preschool child-rearing practices. Rogers (1954) based those practices on three internal psychological conditions theoretically required for creativity: internal locus of evaluation, openness to experiences, and the ability to toy with elements and concepts. Rogers (1954) proposed these three internal conditions were fostered by two external conditions: psychological safety and psychological freedom.

In order to be accorded psychological safety and psychological freedom, children need time to think in the first place. Children have ever increasing opportunities for knowledge gathering and study, so called "empirical abstraction," but to be creative, they also need opportunities to engage in the mental process of building knowledge through mental actions performed on those perceived objects (Piaget, 1981). This "reflective abstraction" is necessary for creative products because new ideas are generated from mental actions, not external objects (Piaget, 1981). Free, uninterrupted time for children should be restored on school and home schedules, so children can engage in reflective abstraction. However, over the past few decades the amount of free play for children has reduced (Hirsh-Pasek, Golinkoff, Berk, & Singer, 2009). Hurried lifestyles and a focus on academics and enrichment activities have led to over-scheduling structured activities and academic-focused programs (Hirsh-Pasek & Golinkoff, 2003), at the expense of playtime (Hirsh-Pasek et al., 2009). Children are also spend ever increasing amounts of their days interacting with electronic entertainment devices.

Reflective abstraction alone is insufficient for generating creativity (Arlin, 1977). Problem finding is necessary for generating new ideas (Arlin, 1977; Getzels & Csikszentmihalyi, 1976) and provides a starting point for creative products (Chand & Runco, 1992). Creativity is motivated by problem finding. Runco and Okuda (1988) found adolescents provide more creative responses to their self-generated problems than to presented problems. Schools and homes need to encourage and teach problem finding, instead of just providing problems for students to solve, if the decline of creative thinking is to be reversed.

Also lost in the rush to provide ever more stimuli and opportunities to children is time for adults to listen to their children. Parents and teachers must personally provide receptive, accepting, and engaged psychological support to encourage creativity. A child needs meaningful interactions and collaborations to be creative (Piaget, 1981; Vygotsky, 1990). Many creative scientists and writers report collaboration promotes creativity (John-Steiner, 2000). Homes and schools should provide opportunities for students to develop teamwork skills (Shorrocks-Taylor & Jenkins, 2000; Torrance, 1978), methods for fairly evaluating peer and self performance, and mechanisms to accept and incorporate criticism (Strom & Strom, 2002). Parents and teachers should make themselves personally available in these roles, but also allow others to do so, to provide a range of perspectives and to encourage development of creative thinking in children.

Among upper grade elementary school children, the decline in creative thinking might arise from some change stifling children's creative thinking in schools. The increased emphasis on standardized testing may have shifted the emphasis in schools toward drill exercises and rote learning, and away from critical, creative thinking. The high-stakes testing environment has led to the elimination of content areas and activities including electives, the arts, enrichment and gifted programs, foreign language, elementary sciences, and elementary recess (playtime), which leaves little room for imagination, scholarship, critical or creative thinking, and problem solving (Gentry, 2006). This may eliminate opportunities for creative students to release their creative energy in school. When their creative needs are not met, students often become underachievers (Kim, 2008b, 2010; Kim & VanTassel-Baska, 2010). Underachievement leads to lower levels of educational attainment (Kim, 2008b), and high school students who are creative are more likely to dropout than other students, according to Kim and Hull's (in press) examination of data sets from the National Educational Longitudinal Study (NELS: 88) and Educational Longitudinal Study (ELS: 2002).

Countries such as China, Japan, Korea, and Taiwan have modeled their educational systems after the

American education system because of America's previous success in encouraging creativity in children (Kim, 2005b). Conversely, the U.S. educational system has implemented standardized testing to pursue measurable outcomes, and is even adopting national educational standards (Lewin, 2010, July 21). Those outcomes are achieved according to measures of IQ and SAT, but they fail according to TTCT creative thinking test scores. To reverse decline in creative thinking, the United States should reclaim opportunities for its students and teachers to think flexibly, critically, and creatively. Standardization should be resisted. Novel creative thought and expression should be encouraged, and opportunities should be made available for participation in active, critical discussion. Older children still need time for reflective abstraction, and they also need their parents and teachers to pay attention to them and support their creative endeavors.

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