Stability and change in interests: A longitudinal examination of grades 7 through college

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Abstract

The joint issue of stability and change of interests in adolescence and early adulthood was investigated longitudinally over three years in three different grade cohorts. The patterns of structural stability, mean stability, rank order stability, and profile stability as well as how these patterns were moderated by gender were examined based on three cohorts of grades 7 and 8 (n=3191), grades 9 and 10 (n=6818), and grades 11 and 12 (n=1078) using the Personal Globe Inventory-Short (Tracey, 2010). Results indicated that adherence to the RIASEC circular model was high and stable; there was a lack of appreciable change in interest means; interests were stable; interest crystallization, profile, and pattern were stable. While the results supported late adolescence and early adulthood being a stable period for interests in general, more changes were found among male and younger students. The implication of the current study was discussed along with its limitations and suggestions for future research.

Key words: Interest development; Interest stability; Longitudinal examinations of interests; Interests in adolescence and early adulthood;

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There have been two apparently conflicting aspects central to interest assessment: stability and development. Holland's (1997) model proposes person-environment fit, which emphasizes identification of stable individual differences (i.e., stable interests) and their predictive utility. In contrast, Super's (1957) model focuses on development of interests over time (i.e., developing interests). There has been research investigating the joint issue of stability and development of interests in adolescence from grades 8th through 12th, which represents an age span from 12 to 18 in the U.S. school system (e.g.,(Tracey, Robbins, & Hofsess, 2005; Tracey & Robbins, 2005). However, the stability and development of interests in late adolescence and early adulthood (i.e., grades 12th through college) remains less clear. The focus of the current study was thus to expand the previous research by examining the joint issue of stability and change in late adolescence and early adulthood.

The stability of interests has served as a central assumption in person-environment fit theory. While interests have been revealed to predict career choice and satisfaction (Bartling & Hood, 1981; Holland & Gottfredson, 1975; Leuwerke, Robbins, Sawyer, & Hovland, 2004; Rounds & Su, 2014), the predictive validity of interests relies on their stability. If interests themselves change substantively, the match of interests to majors and occupations is tenuous. For example, the person-environment congruence is a central construct for vocational psychology based on the models of both Parsons (1909) and Holland (1997). However, there has been less than robust support for the person-environment congruence hypothesis (Spokane, Meir, & Catalano, 2000; Tinsley, 2000). One of the reasons, particularly for longitudinal research, could be that interests themselves change and evolve over time.

However, there is no simple means of conceptualizing stability or change of interests (Swanson, 1999; Tracey & Sodano, 2008). In this study, we focused on several different indices of change/stability as each provides a different picture: structural difference, mean difference, rank order difference, and profile similarity. Each of these captures a unique aspect of stability/change of interests and examining only one would present an inaccurate picture. Therefore, a comprehensive examination of interests based on these four methods of measuring stability/change is necessary.

Structural difference describes the structural change of interests in terms of adherence to the RIASEC circumplex model (Holland, 1997). The RIASEC circumplex model proposed that the six types of interests (i.e., Realistic, Investigative, Artistic, Social, Enterprise, and Conventional) are arranged on a circular (hexagonal) structure based on the relative similarities/differences among them (Holland, 1997). The relations of adjacent interest types (e.g., R and I) are greater than those of alternate interest types (e.g., R and A), which are greater than those of opposite interest types (e.g., R and S). The structural difference is a foundational assessment of the stability/change of interests as it affects the interpretation of interest scales and match to majors and occupations.

The research investigating the structural variation of interests has suggested structural stability in early to middle adolescence (Tracey, 2002a; Tracey et al., 2005; Tracey & Robbins, 2005). Tracey (2002a) examined the one-year longitudinal development of interests in 5th and 8th grade students and found that the RIASEC circular structure was prominent and stable in 8th grade students. In the subsequent research, these results were consistent that the RIASEC structure was stable from 8th grade through 12th grade regardless of gender and ethnicity (Tracey et al., 2005; Tracey & Robbins, 2005). Therefore, a pattern of structural stability from grade 8 to college across gender was anticipated in the current study.

The mean difference of interests describes the change of interest levels between two assessments. Mean stability takes account of levels of interest scales and thus represents the absolute change of interest scales. There has been research consistently revealing an increase of Realistic from grade 8 to grade 12 regardless of gender and ethnicity (Tracey et al., 2005; Tracey & Robbins, 2005). However, overall there is a lack of appreciable change in levels from middle school to high school (Tracey et al., 2005; Tracey & Robbins, 2005). This result is consistent with the findings of a thirty-year follow-up on high school students that only minor mean changes were detected (Rottinghaus, Coon, Gaffey, & Zytowski, 2007). In contrast to stability of means found in adolescence, significant decrease of interests were found in the development from elementary school to middle school (Tracey, 2002a; Tracey & Ward, 1998).

The change of interest levels from children to early adolescence is attributable to a more realistic and comparative evaluation of the self when individuals become more aware of the social clues (Osipow, 1983; Rohlfing, Nota, Ferrari, Soresi, & Tracey, 2012). For example, as adolescents begin to incorporate more gender information from peers and the society, they are likely to develop an interest pattern consistent with gender stereotypes. It has been argued that the different experiences of women in the socialization process may result in different patterns of interest development during adolescence (Betz, 1994; Gottfredson, 1981; Harmon, 1989). This change has been demonstrated in the robust gender difference on interests that males like things-related jobs and females like people-related jobs (e.g.,(Tracey et al., 2005; Tracey & Robbins, 2005). Su et al. (2009) meta-analytically found that men showed stronger Realistic (Cohen's d = .84) and Investigative (Cohen's d = .26) interests and women showed stronger Artistic (Cohen's d = -.35), Social (Cohen's d = -.68), and Conventional (Cohen's d = -.33) interests. Therefore, we anticipated a stable pattern of interests between males and females from grade 8 to college in the current study.

The rank order difference of interests describes the change of interests in terms of the relative position within a group. Rank order difference captures the interindividual variation of interests and thus represents the relative change of interest scales. There has been a wealth of research investigating the rank order difference of interests (also known as test-retest reliability) (e.g.,(Hansen & Stocco, 1980; Tracey et al., 2005; Tracey & Robbins, 2005). While Hansen and Stocco (1980) revealed a test-retest reliability of .72 based on 70 adolescents, Tracey and his colleagues used a large national ACT sample and found test-retest reliability ranging from .54 to .69 (Tracey et al., 2005; Tracey & Robbins, 2005). Low, Yoon, Roberts, and Rounds (2005) meta-analytically examined rank order correlation and found correlation coefficients of .55 to .58 through middle school and high school. They also found that interest stability reached a plateau at the college years as can been seen by a correlation estimate of .70. All these results consistently suggested high rank order stability through adolescence and we thus anticipated a similar pattern in the current study.

While the mean and rank order differences portray the stability/change of individual interest scales, the profile difference of interests describes the change of interest profiles (i.e., all RIASEC scales). There have been three distinct methods of conceptualizing the profile difference of interests: interest crystallization, profile difference, and profile correlation. Since RIASEC scores fall on a two-dimensional circle, every person's profile of RIASEC scores can be represented by a point within this circle. Interest crystallization, which is marked by the distance of this point to the origin, depicts the differentiation of interest RIASEC profiles. The difference between interest crystallization thus represents the change of profile differentiation. Profile difference is defined as summed squared deviations of profile scores across two time points. It thus indicates the difference of two interest profiles within individuals. Profile correlation is defined as the test-retest correlation of the RIASEC profile scores within individuals (i.e., intraindividual variation). It thus indicates the

consistency of two interest profiles within individuals. Cronbach and Gleser (1953) stated three aspects of profile data: level, dispersion, and pattern. While interest crystallization and profile difference take account of level, dispersion and pattern of the RIASEC scales, profile correlation only takes account of dispersion and pattern.

It is commonly hypothesized that individuals crystalize their interests as they age (Osipow, 1983; Super, 1980). With increasing exposure and life experiences, adolescents are expected to develop a more differentiated interest pattern, which is hypothesized to relate to a better career decision-making outcome (Holland, 1997; Super, 1980). Tracey and his colleagues investigated interest crystallization from grades 8 through 12 and found that interests were more crystallized over time. (Tracey et al., 2005; Tracey & Robbins, 2005). In addition, they also investigated profile difference using the same samples and design (Tracey et al., 2005; Tracey & Robbins, 2005). They found that profile difference became smaller over time, attesting to the increasing stability of the RIASEC scores over time. Hansen and Swanson (1983) examined the stability of interest profile over a 3.5-year span (i.e., from freshman to senior year) using profile correlation. They found correlation coefficients ranging from .64 to .84, suggesting a high stability in interest profiles. Low et al.'s (2005) meta-analysis also revealed a high profile correlation ranging from .68 to .71. As the previous research suggested increasing interest stability and differentiation, we thus anticipated that interest crystallization and profile correlation increase and profile distance decreases from grade 8 through college.

To summarize, the purpose of our study was to examine the stability and change of interests across multiple grades in the critical late adolescence and early adulthood. We adopted a very complete examination of views of change using a multi-cohort longitudinal design. Specifically we examined change using most all conceivable definitions: structural change, mean change, rank order change, and several different profile change indices. We

also investigated how these changes were moderated by gender and grade. We know of no other research that has examined these many different definitions of change. Unlike these other assessment of stability and change in the literature, we focus on stability and change as it pertains to scores on the Personal Global Inventory (PGI) (Tracey, 2002b, 2010), as it represents the latest development of interest assessment and provides multiple interest scales (e.g., RIASEC).

Method

Sample and Procedures

Students in the state of Wisconsin attend schools that use the Career Locker (formerly WisCareers) career information system (CIDS). As a part of the system, there is career exploration that offers students an opportunity to take interest assessment. Students in the current sample took PGI-S three times over three consecutive years. The students were enrolled in grades from 7th to college, consisting of initial enrollment in grades 7th and 8th (age 12 to 14; n= 3191, 28.8%), grades 9th and 10th (age 14 to 16; n = 6818, 61.5%), and grades 11th and 12th (age 16 to 18; n = 1078, 9.7%). Of the sample, 6026 (54.4%) were females and 5061 (45.6%) were males. The ethnic/racial breakdown was 9.5% African American, 3.2% Asian American, 8.6% Latino/a, 2.2% Native American, 64.6% Anglo American, 3.2% Multiracial American, 3.1% other, and 5.6% no response.

Instruments

The Personal Global Inventory–Short (PGI–S). Personal Globe Inventory-Short (PGI-S) (Tracey, 2010) was a shortened version of the original PGI (Tracey, 2002b) using the item response theory. Participants were asked to respond to 40 unique items, with respect to both the degree of liking ranging from 1 (*strongly dislike very much*) to 7 (*strongly like very much*) and the degree of competence ranging from 1 (*unable to do*) to 7 (*able to do very much*). Sample items are “Seat patrons at a restaurant” and “Install electrical wiring”. The

PGI-S allows for multiple scales of interest. It primarily measures interests in eight basic interest types on the plane defined by the dimensions of People/Things and Ideas/Data (i.e., Social Facilitating, Managing, Business Detail, Data Processing, Mechanical, Natural/Outdoors, Artistic, and Helping), as well as two interest types located at the opposite ends of the dimension of Prestige (i.e., High prestige and Low prestige). It also enables the generation of scores for the RIASEC types. In this study, we only focused on the six RIASEC types and the dimensional scores of People/Things, Data/Ideas, and Prestige.

Derived Measures

Profile Crystallization. The circumplex model of interest has been theorized (Holland, 1997) and demonstrated to fit RIASEC scares (Rounds & Tracey, 1996; Tracey & Rounds, 1995; Tracey & Rounds, 1993). This model specifies that six RIASEC scales are arranged on a circular structure by their relative similarities (e.g., R is most similar to I and C, less similar to A and E, and least similar to S). Prediger (1982) and Prediger and Vansickle (1992) proposed a two-dimension structure of Things/People and Data/Ideas to characterize dimensions underlying the RIASEC circular. Specifically Things/People was calculated as (2*R+I –A - 2*S - E+C) and Data/Ideas was calculated as (1.73*E + 1.73*C- 1.73*I - 1.73*A). High values of Things/People thus indicate an endorsement of things over people and negative scores indicate an endorsement of people over things. High scores on Data/Ideas were indicative of data endorsement while negative scores represented Ideas. Given this structure, an individual RIASEC profile could be represented by two dimensional scores.

Interest crystallization was operationalized by using a length score generated from the two dimensional scores of Things/People and Data/Ideas. Given that the RIASEC profile can be said to exist in a circular structure represented by Things/People and Data/Ideas, the distance between the origin with the point in the circle located by two dimensional scores represents the circular variance (Mardia, 2014). This length score provides an index of the

clarity or crystallization of the RIASEC profile. Such indices have been used in interest (Tracey et al., 2005) and personality (Wiggins, Phillips, & Trapnell, 1989) measures as a means of representing differentiation in a circular structure.

Profile Difference. The profile difference score was selected as it takes account of level, dispersion, and pattern of multivariate data (Cronbach & Gleser, 1953). This index is calculated by squaring the differences between similar scale scores, summing these squared differences across RIASEC scales, and then taking the square root of the sum (e.g., the profile difference between RIASEC scores at time 1 and time 2 equals $\text{SQUAREROOT}((R1-R2)^2 + (I1-I2)^2 + (A1-A2)^2 + (S1-S2)^2 + (E1-E2)^2 + (C1-C2)^2)$. Larger scores indicate greater profile difference. This index was calculated for the differences in the RIASEC profiles between time 1 and time 2, and between time 1 and time 3.

Profile Correlation. We also used profile correlation as another index of profile similarity/differences. In contrast to profile difference, profile correlation is focused on levels of the RIASEC scores. It represents consistency of the RIASEC scales across two assessments within each individual. It is calculated as the correlation of two RIASEC profiles across time. A larger profile correlation indicates a higher RIASEC profile consistency. This index was calculated for the similarity in the RIASEC profile between time 1 and time 2, and between time 1 and time 3.

Results

The liking scale and competence scale of the PGI-S were examined initially in separate analyses. However, the results showed almost identical patterns of stability/change, which was anticipated given the high correlation of these two measures of interests. We therefore only presented the results based on composite scores of the liking scale and competence scale for the purpose of simplicity.

Structural Difference over Time

We first conducted the randomization test of the hypothesized order relations (Rounds, Tracey, & Hubert, 1992; Tracey, 1997) to explicitly examine the circular order of the six-type interest structure of the PGI-S across gender, grade, and time. While the six interest types generate 15 (6*5/2) correlations, the circular structure of these types specifies 72 relation comparisons among all the 105 (15*14/2) possible comparisons, without specifying 33 comparisons within adjacent, alternate, and opposite relations. Based on the circular order, the correlations of adjacent interest types are expected to be greater than those of alternate interest types, which are greater than those of opposite interest types. An exact inferential test is provided by the ratio of the number of times that the number of predictions met was matched or exceeded over the 720 permutations of the rows and columns of the correlation matrix. A *p* value below .05 would suggest rejection of the null conjecture and the theoretically specified circular order of the RIASEC structure would be thus supported. As an interpretive aid, the correspondence index (CI) was calculated as the percentage of met predictions minus the percentage of unmet predictions over the total number of predictions.

Table 1 shows the significance level, CIs for the circular model in each sample as well as the comparison of model fit across assessment year, gender, and initially enrolled grade. The results indicated that the circular order of the RIASEC structure was supported in each sample at very high levels and no significant difference on model fit was detected across assessment year, gender, and initially enrolled grade. Therefore, it was suggested that the RIASEC scales captured similar meanings across samples and further comparison on means and profile was warranted.

Mean Differences over Time

The repeated-measure multivariate analysis of variance yielded significant within-subject effects for time (F (141, 924) = 7.93, $p < .05$, $eta^2 = .055$), time and grade interaction (F (283, 848) = 1.77, $p < .05$, $eta^2 = .013$), and time and gender and grade interaction (F (283, 848) =

1.49, $p < .05$, $eta^2 = .011$). It was also demonstrated that there were significant between-subject effects for gender (F (7, 1931) = 117.64, $p < .05$, $eta^2 = .299$), grade (F (14, 3862) = 4.60, $p < .05$, $eta^2 = .016$), and gender by grade interaction (F (14, 3862) = 2.00, $p < .05$, $eta^2 = .007$).

The univariate analyses for the within-subject effects and the post hoc examination of multi-group comparison are presented in Table 2. It was indicated that all RIASEC interest types decreased over time (i.e., time 1 > time 2 > time 3), while Prestige increased over time (i.e., time1 < time 2 = time 3) but stayed at this high level for the last assessment. There was a significant moderation of this linear effect by grade for Artistic, indicating that students initially enrolled at grades 12th and college hade a quicker drop of Artistic in relative to other students. However, the effect size of this moderation was very modest ($eta^2 = .003$).

The univariate analyses for the between-subject effects indicated that there were gender effects for Realistic, Social, Enterprise, Conventional, Artistic, and Prestige. It was found that male students had higher values on Realistic and Conventional than female students, while female students endorsed Social, Enterprise, Artistic, and Prestige more than male students. When comparing all between-subject effects, it was found that the gender effects for Realistic and Social were more prominent ($eta^2 = .136$ and .125 respectively) than other effects. The main results were thus that males had higher Realistic scores than females and females had higher Social scores than males.

It was demonstrated that there were grade effects for Realistic, Investigative, Enterprise, Conventional, and Prestige. The post-hoc examination indicated that students initially enrolled in grades 7th, 8th, 11th, and 12th had higher values of Realistic and Conventional than students initially enrolled in grades 9th and 10th. It was also indicated that students initially enrolled in grades 7th, 8th, 9th, and 10th had higher values of Investigative, Enterprise, and Prestige than students initially enrolled in grades 11th and 12th.

The between-subject effect of gender x grade interaction was found to be significant on Realistic, Investigative, and Social. It indicated that students initially enrolled in grades 7th and 8th had a smaller gender gap on Realistic (i.e., females < males) and had a reversed gender difference on Investigative (i.e., females > males) relative to students initially enrolled in grades 9th, 10th, 11th, and 12th. It was also indicted that students initially enrolled in grades 11th and 12th had a smaller gender gap on Social (i.e., females > males).

Rank Order Change over Time

The rank order stability was represented by the correlation of the RIASEC scales across two assessment times. Table 3 presented the rank order stability (i.e., test-retest reliability) for females and males over time (year) and initial grade assessed. Over one year, the mean test retest reliability estimate was .66 (.58 to .75). We examined independent correlation comparison and found that there were significant effects for gender on Investigative, Artistic, Social, Enterprise, and Prestige (Z = 2.17 to 11.26), indicating that females had more stable interests than males on those areas. We also found significant effects for grade on Realistic, Artistic, Enterprise, and Conventional (Z = 1.99 to 6.23), indicating that students in older grades had more stable interests than younger students on those areas. While the correlations were moderate to high (r= .47 - .75), it was thus suggested that interests are temporally stable across gender and initial grade.

Profile Crystallization Change over Time

The means and standard deviations of interest profile crystallization scores over time are presented in Table 4. The repeated-measure analysis of variance for profile crystallization scores was presented in Table 5. It was indicated that there were no within-subject effects for time (F (2, 1936) = 2.22, p > .05, eta^2 = .002), time and gender interaction (F (2, 1936) = 1.98, p > .05, eta^2 = .002), time and grade interaction (F (4, 3872) = .70, p > .05, eta^2 = .002), and time and gender and grade interaction (F (4, 3872) = .52, p > .05, eta^2 = .002). The results

thus indicated that interest crystallization was stable over time and the stability of interest crystallization did not vary by gender and grade.

It was also demonstrated that there were significant between-subject effects for gender (F (1, 1937) = 81.81, $p < .05$, eta^2 = .041), grade (F (2, 1937) = 4.05, $p < .05$, eta^2 = .004), and gender and grade interaction (F (2, 1937) = 5.69, $p < .05$, eta^2 = .006). The main effect results indicated that female students had better crystallization than male students, and students initially enrolled in grades 9th and 10th had better crystallization than students initially enrolled in grades 7th, 8th, 11th, and 12th. The moderation effect indicated that there was a smaller gender gap (i.e., females > males) for students initially enrolled in grades 11th and 12th than other grades.

As can be seen by the value of eta^2 (.041), the gender effect was more prominent than other between-subject effects. The main result of between-subject effects was thus that females had better profile crystallization scores than males, suggesting that females have a more differentiated interest profile than males.

Profile Difference Change over Time

The means and standard deviations of interest profile difference scores over time are presented in Table 6.The repeated-measure analysis of variance for profile difference scores was presented in Table 7. It was demonstrated that there were significant within-subject effects for time (F (1, 1937) = 15.91, $p < .05$, eta^2 = .008) and time x gender x grade interaction (F (2, 1937) = 5.66, $p < .05$, eta^2 = .006). The main effect result thus indicated that there were more profile differences between time 1 and time 3 than between time 1 and time 2. The moderation results indicated that female students initially enrolled in grades 7th and 8th had more profile difference over time (i.e., profile difference $_{1\text{-}2}$ < profile difference $_{1\text{-}3}$) than female students initially enrolled in other grades. On the other hand, males students initially enrolled in grades 7th and 8th had a reversed pattern of profile difference (i.e., profile

difference $_{1\text{-}2}$ > profile difference $_{1\text{-}3}$) relative to male students in other grades (i.e., profile difference $_{1\text{-}2}$ < profile difference $_{1\text{-}3}$). However, both main and moderation effects were small as can be seen by the effect sizes.

It was also demonstrated that there were significant between-subject effects for gender (F (1, 1937) = 21.39, p < .05, eta^2 = .011), grade (F (2, 1937) = 21.33, p < .05, eta^2 = .022), and gender and grade interaction (F (2, 1937) = 3.41, p < .05, eta^2 = .004). The results thus indicated that in general male students had more profile difference over time than female students and students initially enrolled in grades 7th and 8th had more profile difference over time than students in grades 9th, 10th, 11th, and 12th. The moderation results indicated that students initially enrolled in younger grades had larger gender gaps on profile difference over time (i.e., males > females)

As can be seen by the value of eta^2 (.022), the between-subject effect of grade was more prominent than other between- and within-subject effects. Therefore, the main result was a linear association of grades with interest profile change over time (Grade 7th and 8th > Grade 9th and 10th > Grade 11th and 12th). It was suggested that younger individuals tend to have more change in their interest profile over time.

Profile Correlation Change over Time

The means and standard deviations of interest profile correlation scores over time are presented in Table 6. The repeated-measure analysis of variance for profile correlation scores was presented in Table 7. It was indicated that there was only a significant within-subject effect for time (F (1, 1806) = 19.27, p < .05, eta^2 = .011). The result indicated that there were more profile similarities between time 1 and time 2 than between time 1 and time 3.

It was also demonstrated that there was only a significant between-subject effect for gender (F (1, 1806) = 9.79, p < .05, eta^2 = .005). The result indicated that female students had more profile similarities over time compared to male students.

As can be seen by the value of eta^2, the within-subject effect of time was more prominent than the between-subject effect of grade (i.e., .011 vs. .005). The main result was thus that there was a higher correlation in profiles between time 1 and 2 relative to profile correlation between time 1 and 3.

Summary of Results

Based on the effect sizes, the first major result revealed was that gender had relatively prominent effects on Realistic, Social, and Prestige, suggesting that male students have higher Realistic than female students, while female students endorsed Social and Prestige more than male students.

The second major result was that there were grade effects on Conventional and profile distances. It was thus suggested that students initially enrolled in grades 7th, 8th, 11th, and 12th have higher values of Conventional than students initially enrolled in grades 9th and 10th and younger individuals tend to have more change in their interest profile over time (i.e., profile difference).

The third major result was that there were time effects on Conventional, Prestige, and profile correlation. It was thus suggested that Conventional decreased over time regardless of grade (i.e., time 1 > time 2 > time3), while Prestige increased over time regardless of grade (i.e., time1 < time 2 = time3). It was also suggested that individual profile pattern changes over time regardless of gender and grade. However, overall the profile pattern was stable.

The last major result was that there was no time effect on profile crystallization. It was thus suggested that interest crystallization is stable across grades 7th, 8th, 9th, 10th, 11th, 12th, and college and this stability applies to both genders. It was also found that there were no gender and grade effects on rank order stability, suggesting that interests were temporally stable across gender and initial grade.

Discussion

The current study investigated the joint issue of stability and change of interests over the span of middle adolescence to early adulthood using four indices: structural stability, mean stability, rank order stability, and profile stability (i.e., interest crystallization, profile difference, and profile correlation). The results of this study were expansive but the main finding was that interests were generally stable but also changing over time from adolescence to early adulthood.

Students in the current study endorsed a high adherence to the RIASEC circular structure and this structural adherence did not vary by assessment time, gender, and grade. The current results were thus consistent with the previous research (e.g.,(Tracey, 2002a; Tracey et al., 2005; Tracey & Robbins, 2005) showing a stable and prominent RIASEC structure in adolescence. It was also noticed that the CI values from the PGI used in this study were higher than the U.S. standard for the RIASEC scales found in Tracey and Rounds' (1993) meta-analysis. Therefore, a pattern of structural stability of interests was supported in adolescence and early adulthood.

The current study found that interests changed in terms of mean levels from adolescence to early adulthood. It was revealed that all RIASEC interest types decreased over years (i.e., time 1 > time 2 > time 3), while Prestige increased over years (i.e., time1 < time 2 = time 3) but stayed at this high level for the last assessment. However, the small effect size for time on the RIASEC scales indicated a practically negligible change, which was consistent with the previous finding of a lack of appreciable change over middle and high school (Tracey et al., 2005; Tracey & Robbins, 2005). Collectively, these results thus revealed a pattern of stability of the RIASEC levels from adolescence to early adulthood. In addition, the current study provided a piece of new information regarding how students' interest in prestige develops over time. As individuals enter adolescence, they become more aware of social clues (Osipow, 1983; Rohlfing et al., 2012) and begin to incorporate more societal values, such as

prestige (Gottfredson, 1981). The current finding thus supported the increasing interest in prestige among adolescents and early adults. The finding that males had higher Realistic scores than females and females had higher Social scores than males served as another example of socialization at this developmental stage, which was not surprising given the previous research (Su et al., 2009; Tracey et al., 2005; Tracey & Robbins, 2005).

The current study found a moderate to high rank order stability of interests and this stability did not vary by gender and initial grade. These results (i.e., one year r = .58 - .75) were consistent with the previous research (e.g.,(Hansen & Stocco, 1980; Tracey et al., 2005; Tracey & Robbins, 2005) showing a pattern of temporal stability of interests through adolescence (one year r = .54 - .72). The current study thus suggested that interests are stable in terms of relative position within a group over the years from adolescence to early adulthood. It was also suggested that female and older students have more stability than male and younger students on many interest scales, which is consistent with the previous findings (Tracey et al., 2005; Tracey & Robbins, 2005).

While we anticipated increasing interest crystallization over years based on the developmental perspective (Super, 1957), the current study did not support this assumption. Instead, the results showed that interest crystallization was stable from adolescence through early adulthood. While the previous research found that interests were more crystallized over time in adolescence (Tracey et al., 2005; Tracey & Robbins, 2005), the revealed time effect is much less prominent compared to the gender effect. Together with the previous research, the current study thus suggested that interest crystallization could reach a plateau at adolescence and early adulthood. In addition, the present study found that females had higher interest crystallization than males. This result was consistent with the previous finding (Tracey et al., 2005), suggesting that interests of female students are more differentiated than those of male students.

The current study found that profile difference was associated with time span, indicating that interest profile changed over time. However, the time effect was small. It was also found that there was a linear association of grades with profile difference (Grade 7th and 8th > Grade 9th and 10th > Grade 11th and 12th), suggesting that younger individuals tend to have more change in their interest profile over time. While profile difference has been found to become smaller over time in adolescence (Tracey et al., 2005; Tracey & Robbins, 2005), the current result further attested to the stability of interests at early adulthood.

Last, the current study found that profile correlation was changing over time, indicating that interest profile changes in adolescence and early adulthood. However, the values of profile correlation was moderate to high (*r*'s .68 to .81), which was consistent with the finding revealed in Hansen and Swanson's (1983) study and Low et al.'s (2005) meta-analysis. Therefore, the results suggested that interest profile changes but remains relatively stable through adolescence and early adulthood.

The present study investigated the longitudinal development of interests from adolescence to early adulthood using multiple grade groups. While this examination covered the entire span of adolescence and early adulthood, future longitudinal research using a single group all through adolescence and early adulthood is needed in order to reduce confounding factors. Furthermore, it would be interesting to see future research investigating the stability/change of interests across different cultural and ethnic groups. While Rounds and Tracey (1996) found a lack of cross-cultural structural equivalence of interests for most RIASEC measures, current research with the PGI yields better structural support (e.g.,(Caulum, Tracey, Gresham, & McCarty, 2011; Darcy, 2005; Hedrih, 2008; Long, Adams, & Tracey, 2005; Long, Watanabe, & Tracey, 2006; Šverko, 2008; Tracey, Watanabe, & Schneider, 1997; Wilkins, Ramkissoon, & Tracey, 2013). We thus suspected that the development of interests in adolescence and early adulthood might demonstrate some

similarity cross-culturally.

The present study extended the previous research by examining the longitudinal development of interests in the critical period of late adolescence and early adulthood. While it supported both the developmental model (e.g.,(Super, 1957) and the stable trait-like model (e.g.,(Holland, 1997) of interests, the major pattern revealed was a promising stability of interests in late adolescence and early adulthood. This finding therefore substantiates the application of the person-environment fit model and the predictive validity of interest assessment among students in late adolescence and early adulthood. Also, it was suggested that it could be helpful to focus interventions on male and younger students to assist in helping them sort out interests, as they experience more flux of interests.

Reference

Bartling, H. C., & Hood, A. B. (1981). An 11-year follow-up of measured interest and vocational choice. *Journal of Counseling Psychology, 28*, 27-35.

Betz, N. E. (1994). Basic issues and concepts in career counseling for women. In W. B. W. S. H. Osipow (Ed.), *Career counseling for women* (pp. 1-41). Hillsdale, NJ: Erlbaum.

Caulum, D., Tracey, T., Gresham, S., & McCarty, K. (2011). Technical report: Re-validation studies of the PGI and other ecareers. sg assessments. *Madison, WI: Center for Work and Education, University of Wisconsin*.

Cronbach, L. J., & Gleser, G. C. (1953). Assessing similarity between profiles. *Psychological Bulletin, 50*, 456-473. doi: http://dx.doi.org/10.1037/h0057173

Darcy, M. U. (2005). Examination of the structure of Irish students' vocational interests and competence perceptions. *Journal of Vocational Behavior, 67*, 321-333.

Gottfredson, L. S. (1981). Circumscription and compromise: A developmental theory of occupational aspirations. *Journal of Counseling Psychology, 28*, 545-579. doi: http://dx.doi.org/10.1037/0022-0167.28.6.545

Hansen, J.-I. C., & Stocco, J. L. (1980). Stability of Vocational Interests of Adolescents and Young Adults. *Measurement and Evaluation in Guidance, 13*, 173-178.

Hansen, J.-I. C., & Swanson, J. L. (1983). Stability of interests and the predictive and concurrent validity of the 1981 Strong-Campbell Interest Inventory for college majors. *Journal of Counseling Psychology, 30*, 194-201.

Harmon, L. W. (1989). Longitudinal changes in women's career aspirations: Developmental or historical? *Journal of Vocational Behavior, 35*, 46-63.

Hedrih, V. (2008). Structure of vocational interests in Serbia: Evaluation of the spherical model. *Journal of Vocational Behavior, 73*, 13-23.

Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities and work environments* (3rd ed.). Odessa, FL: Psychological Assessment Resources.

Holland, J. L., & Gottfredson, G. D. (1975). Predictive value and psychological meaning of vocational aspirations. *Journal of Vocational Behavior, 6*, 349-363.

Leuwerke, W. C., Robbins, S., Sawyer, R., & Hovland, M. (2004). Predicting engineering major status from mathematics achievement and interest congruence. *Journal of Career Assessment, 12*, 135-149.

Long, L., Adams, R. S., & Tracey, T. J. (2005). Generalizability of interest structure to China: Application of the Personal Globe Inventory. *Journal of Vocational Behavior, 66*, 66-80.

Long, L., Watanabe, N., & Tracey, T. J. (2006). Structure of interests in Japan: Application of the personal globe inventory occupational scales. *Measurement and evaluation in counseling and development, 38*, 222-235.

Low, K. d., Yoon, M., Roberts, B. W., & Rounds, J. (2005). The stability of vocational interests from early adolescence to middle adulthood: a quantitative review of longitudinal studies. *Psychological Bulletin, 131*, 713-737.

Mardia, K. V. (2014). *Statistics of directional data*: Academic press.

Osipow, S. H. (1983). *Theories of career development* (3rd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Parsons, F. (1909). *Choosing a vocation*: Houghton Mifflin Company.

Prediger, D. J. (1982). Dimensions underlying Holland's hexagon: Missing link between interests and occupations? *Journal of Vocational Behavior, 21*, 259-287.

Prediger, D. J., & Vansickle, T. R. (1992). Locating occupations on Holland's hexagon: Beyond RIASEC. *Journal of Vocational Behavior, 40*, 111-128.

Rohlfing, J. E., Nota, L., Ferrari, L., Soresi, S., & Tracey, T. J. (2012). Relation of occupational knowledge to career interests and competence perceptions in Italian children. *Journal of Vocational Behavior, 81*, 330-337. doi: 10.1016/j.jvb.2012.08.001

Rottinghaus, P. J., Coon, K. L., Gaffey, A. R., & Zytowski, D. G. (2007). Thirty-year stability and predictive validity of vocational interests. *Journal of Career Assessment, 15*, 5-22.

Rounds, J., & Su, R. (2014). The nature and power of interests. *Current directions in psychological science, 23*, 98-103.

Rounds, J., & Tracey, T. J. (1996). Cross-cultural structural equivalence of RIASEC models and measures. *Journal of Counseling Psychology, 43*, 310.

Rounds, J., Tracey, T. J., & Hubert, L. (1992). Methods for evaluating vocational interest structural hypotheses. *Journal of Vocational Behavior, 40*, 239-259.

Spokane, A. R., Meir, E. I., & Catalano, M. (2000). Person–Environment Congruence and Holland's Theory: A Review and Reconsideration. *Journal of Vocational Behavior, 57*, 137-187. doi: http://dx.doi.org/10.1006/jvbe.2000.1771

Su, R., Rounds, J., & Armstrong, P. I. (2009). Men and things, women and people: a meta-analysis of sex differences in interests. *Psychological Bulletin, 135*, 859.

Super, D. E. (1957). *The Psychology of Careers: An Introduction to Vocational Development*. New York: Harper.

Super, D. E. (1980). A life-span, life-space approach to career development. *Journal of Vocational Behavior, 16*, 282-298.

Šverko, I. (2008). Spherical model of interests in Croatia. *Journal of Vocational Behavior, 72*, 14-24.

Swanson, J. L. (1999). Stability and change in vocational interests. In M. L. S. A. R. Spokane (Ed.), *Vocational interests: Meaning, measurement, and counseling use* (pp. 135-158). Palo Alto, CA: Davies-Black.

Tinsley, H. (2000). The Congruence Myth: An Analysis of the Efficacy of the Person–Environment Fit Model. *Journal of Vocational Behavior, 56*, 147-179.

Tracey, T. J. (1997). RANDALL: A Microsoft FORTRAN program for a randomization test of hypothesized order relations. *Educational and Psychological Measurement*, 164-168.

Tracey, T. J. (2002a). Development of interests and competency beliefs: A 1-year longitudinal study of fifth-to eighth-grade students using the ICA-R and structural equation modeling. *Journal of Counseling Psychology, 49*, 148-163.

Tracey, T. J. (2002b). Personal Globe Inventory: Measurement of the spherical model of interests and competence beliefs. *Journal of Vocational Behavior, 60*, 113-172.

Tracey, T. J. (2010). Development of an abbreviated Personal Globe Inventory using item response theory: The PGI-Short. *Journal of Vocational Behavior, 76*, 1-15.

Tracey, T. J., Robbins, S. B., & Hofsess, C. D. (2005). Stability and change in interests: A longitudinal study of adolescents from grades 8 through 12. *Journal of Vocational Behavior, 66*, 1-25.

Tracey, T. J., & Rounds, J. (1995). The arbitrary nature of Holland's RIASEC types: A concentric-circles structure. *Journal of Counseling Psychology, 42*, 431-439.

Tracey, T. J., & Rounds, J. B. (1993). Evaluating Holland's and Gati's vocational-interest models: A structural meta-analysis. *Psychological Bulletin, 113*, 229-246.

Tracey, T. J., & Ward, C. C. (1998). The structure of children's interests and competence perceptions. *Journal of Counseling Psychology, 45*, 290-303.

Tracey, T. J., Watanabe, N., & Schneider, P. L. (1997). Structural invariance of vocational interests across Japanese and American cultures. *Journal of Counseling Psychology, 44*, 346-354.

Tracey, T. J. G., & Robbins, S. B. (2005). Stability of interests across ethnicity and gender: A longitudinal examination of grades 8 through 12. *Journal of Vocational Behavior, 67*, 335-364.

Tracey, T. J. G., & Sodano, S. M. (2008). Issues of Stability and Change in Interest Development. *The Career Development Quarterly, 57*, 51-62. doi: 10.1002/j.2161-0045.2008.tb00165.x

Wiggins, J. S., Phillips, N., & Trapnell, P. (1989). Circular reasoning about interpersonal behavior: Evidence concerning some untested assumptions underlying diagnostic classification. *Journal of Personality and Social Psychology, 56*, 296-305.

Wilkins, K. G., Ramkissoon, M., & Tracey, T. J. (2013). Structure of interest in a Caribbean sample: Application of the Personal Globe Inventory. *Journal of Vocational Behavior, 83*, 367-372.

Table 1. Structural Indices for Females and Males over Time (year) and Initial Grade Assessed

Population	CI	*p*	Comparison (*p*)
Year 1	0.88	0.02	1.00 (Year 1 vs. Year 2)
Year 2	0.85	0.02	.65 (Year 2 vs. Year 3)
Year 3	0.85	0.02	.63 (Year 1 vs. Year 3)
Males	0.68	0.02	.95 (Males vs. Females)
Females	0.86	0.02	
Grade 7th and 8th	0.81	0.02	0.65 (Grade 7and 8 vs. Grade 9 and 10)
Grade 9th and 10th	0.86	0.02	0.92 (Grade 9 and 10 vs. Grade 11 and 12)
Grade 11th and 12th	0.94	0.02	0.97 (Grade 7 and 8 vs. Grade 11 and 12)

Table 2. Post Hoc Univariate Tests of Within-Subject and Between-Subject Effects of Interest Scores over Time

Measure	Within Effects			Between Effects		
	F	*eta*^{2}	post hoc	*F*	*eta*^{2}	post hoc
	Time effect [a]			Gender [c]		
Realistic	19.38*	0.010	1>2>3	304.39*	0.136	M>F
Investigative	13.62*	0.007	1>2>3	0.73	0.000	
Artistic	15.87*	0.008	1>2>3	42.24*	0.021	F>M
Social	13.34*	0.007	1>2>3	275.59*	0.125	F>M
Enterprise	18.89*	0.010	1>2>3	25.44*	0.013	F>M
Conventional	20.73*	0.011	1>2>3	67.93*	0.034	M>F
Prestige	23.74*	0.012	1<2=3	129.93*	0.063	F>M
	Time x gender effect [a]			Grade [d]		
Realistic	0.57	0.000		5.29*	0.005	1=3>2 [e]
Investigative	0.5	0.000		5.99*	0.006	1=2<3 [e]
Artistic	1.79	0.001		3.90*	0.004	
Social	2.43	0.001		0.29	0.000	
Enterprise	1.55	0.001		6.60*	0.007	1=2<3 [e]
Conventional	1.13	0.001		11.49*	0.012	1=3>2 [e]
Prestige	1.47	0.001		6.36*	0.007	1=2<3 [e]
	Time x grade effect [b]			Gender * Grade [d]		
Realistic	1.01	0.001		3.21*	0.003	
Investigative	0.97	0.001		3.19*	0.003	
Artistic	2.92*	0.003		0.57	0.001	
Social	0.77	0.001		5.40*	0.006	

Enterprise	0.45	0.000	0.47	0.000
Conventional	0.78	0.001	0.75	0.001
Prestige	0.99	0.001	1.73	0.002
Time x gender x grade effect [b]				
Realistic	0.36	0.000		
Investigative	0.63	0.001		
Artistic	1.98	0.002		
Social	0.76	0.001		
Enterprise	0.28	0.000		
Conventional	0.76	0.001		
Prestige	2.03	0.002		

[a] *df* for F =2, 3874; [b] *df* for F =4, 3874; [c] *df* for F =1, 1937; [d] *df* for F = 2, 1937;

[e] 1= grade 7th and 8th; 2 = grade 9th and 10th; 3= grade 11th and 12th

*$P < .05$

Table 3. Rank Order Stability for Females and Males over Time (year) and Initial Grade Assessed

Population	Year 1 to Year 2							Year 1 to Year 3						
	R	I	A	S	E	C	P	R	I	A	S	E	C	P
Males	0.58	0.63	0.64	0.58	0.59	0.58	0.67	0.53	0.56	0.56	0.52	0.51	0.54	0.64
Females	0.60	0.71	0.75	0.64	0.64	0.65	0.61	0.52	0.63	0.68	0.59	0.58	0.60	0.56
Grade 7 and 8	0.65	0.66	0.70	0.67	0.58	0.61	0.68	0.50	0.57	0.55	0.55	0.47	0.49	0.69
Grade 9 and 10	0.68	0.67	0.71	0.70	0.62	0.63	0.67	0.63	0.60	0.66	0.65	0.57	0.60	0.61
Grade 11 and 12	0.71	0.72	0.75	0.68	0.68	0.73	0.74	0.68	0.63	0.73	0.65	0.64	0.69	0.63

Table 4. Means and Standard Deviations of Profile Crystallization Scores for Females (n=1104) and Males (n=839) over Time (year) and Initial Grade Assessed

Measure	Year 1		Year 2		Year 3	
	Mean	*SD*	Mean	*SD*	Mean	*SD*
Grade 7th and 8th (n=402)						
Crystallization						
Males	77.41	55.31	69.76	60.97	74.30	53.27
Females	107.86	54.81	107.30	52.97	108.05	52.41
Grade 9th and 10th (n=1271)						
Crystallization						
Males	87.85	52.23	82.89	53.94	82.61	48.76
Females	110.38	52.22	109.59	55.43	113.21	54.37
Grade 11th and 12th (n=270)						
Crystallization						
Males	91.66	52.31	89.14	50.97	84.85	50.33
Females	98.80	52.67	98.89	50.88	96.38	50.19

Table 5. Within-Subject and Between-subject Effects of Profile Crystallization Scores over Time

Within Effects				Between Effects			
variables	*F*	*Sig.*	*eta*^{2}	variables	*F*	*Sig.*	*eta*^{2}
Crystallization							
time	2.22 [a]	0.109	0.002	Gender	81.81 [e]	0.000	0.041
time * gender	1.98 [b]	0.138	0.002	Grade	4.05 [f]	0.018	0.004
time * Grade	0.70 [c]	0.591	0.001	Gender * Grade	5.69 [g]	0.003	0.006
time * gender * Grade	0.52 [d]	0.719	0.001				

[a-b] *df* for *F* = 2, 1936; [c-d] *df* for *F* = 4, 3872; [e] *df* for *F* = 1, 1937; [f-g] *df* for *F* = 2, 1937;

*$P < .05$

Table 6. Means and Standard Deviations of Profile Difference and Profile Correlation Scores for Females (n=1104) and Males (n=839) over Time (year) and Initial Grade Assessed

Population	Profile difference				Profile correlation			
	Year 1 to Year 2		Year 1 to Year 3		Year 1 to Year 2		Year 1 to Year 3	
	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
Grade 7th and 8th (n=402)								
Males	51.43	46.11	48.10	38.08	0.73	0.37	0.73	0.30
Females	35.56	28.36	42.35	29.60	0.79	0.31	0.74	0.32
Grade 9th and 10th (n=1271)								
Males	39.95	34.47	42.87	26.96	0.75	0.33	0.68	0.34
Females	32.87	19.11	37.21	19.01	0.81	0.27	0.77	0.25
Grade 11th and 12th (n=270)								
Males	29.71	18.07	36.37	23.55	0.77	0.33	0.70	0.37
Females	30.81	20.28	32.99	19.22	0.79	0.29	0.76	0.32

Table 7. Within-Subject and Between-subject Effects on Profile Difference and Profile Correlation Scores for Females (n=1104) and Males (n=839) over Time (year) and Initial Grade Assessed

Within Effects				Between Effects			
variables	*F*	*Sig.*	eta^2	variables	*F*	*Sig.*	eta^2
Profile Difference							
time	15.91[a]	0.000	0.008	Gender	21.39[i]	0.000	0.011
time * gender	2.07[b]	0.150	0.001	Grade	21.33[j]	0.000	0.022
time * Grade	0.88[c]	0.414	0.001	Gender * Grade	3.41[k]	0.033	0.004
time * gender * Grade	5.66[d]	0.004	0.006				
Profile Correlation							
time	19.27[e]	0.000	0.011	Gender	9.79[l]	0.002	0.005
time * gender	.31[f]	0.580	0.000	Grade	0.07[m]	0.931	0.000
time * Grade	1.14[g]	0.320	0.001	gender * Grade	0.98[n]	0.374	0.001
time * gender * Grade	2.05[h]	0.130	0.002				

[a-b] *df* for $F = 1, 1937$; [c-d] *df* for $F = 2, 1937$; [e-f] *df* for $F = 1, 1806$; [g-h] *df* for $F = 2, 1806$;

[i] *df* for $F = 1, 1937$; [j-k] *df* for $F = 2, 1937$; [l] *df* for $F = 1, 1806$; [m-n] *df* for $F = 2, 1806$;

Highlights

- Stability and change of interests was investigated longitudinally over three years in three different grade cohorts
- Adherence to the RIASEC circular model was high and stable
- There was a lack of appreciable change in interest means
- Interest crystallization, profile, and pattern were stable
- More changes were found among male and younger students