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The impact of person-environment fit on grades, perceived gains, and satisfaction: an application of Holland's theory

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Abstract
Holland's theory of vocational choice is a powerful framework for studying academic environments and student development in college. This study tests Holland's third proposition that students flourish in academic environments (i.e., majors) that are congruent with their personality types. In addition, we examine the extent to which student characteristics influence person-environment fit. Findings indicated that student characteristics and personality type were significantly related to person-environment fit. Moreover, person-environment fit is positively related to self-reported grades. However, person-environment was not significantly related to either perceived learning gains or satisfaction with college.

Keywords Holland's theory · Person-environment fit · Student engagement · Learning outcomes

Selection of an academic major is one of the most important choices made by college students (Porter and Umbach 2006). Students' choice of academic major determines many of the courses they will take, which in turn affects the kinds of abilities, skills, and competencies the students will develop (Feldman et al. 2001, 2004; Smart et al. 2000). In addition to cognitive skill development, academic areas of study affect students after graduation,

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influencing career options, satisfaction, and income (Angle and Wissmann 1981). Academic environments (i.e., academic majors) are a primary influence on students' progress in college (Feldman et al. 2001, 2004; Smart and Feldman 1998). These environments "reinforce and reward distinctive professional and personal self-perceptions, competencies, attitudes, interests, and values" (Smart et al. 2006, p. 354).

Holland's (1997) theory of vocational choice is a useful framework for studying academic environments and student development in college (Smart et al. 2000). Holland argues that human behavior is a function of interactions between individuals and environments. A major tenet of the theory focuses on the interaction or fit between individuals and their environments. While Holland's theory was originally intended to assist individuals in selecting a career, Holland (1997, p. 71) indicates that his theory is equally applicable in educational settings. In postsecondary research, Holland's theory has been used to study a variety of educational objectives including the process of choosing a major (Porter and Umbach 2006), the role academic environment plays in students' plans to attend graduate school (Rocconi et al. 2015), the socialization process that academic environments have on students (Feldman et al. 2008), and the effects of student-environment fit on learning and development (Smart et al. 2000). The present research tests one of Holland's main propositions that the students flourish in academic environments (i.e., majors) that are congruent with their personality types.

Theoretical framework

The basic premise of Holland's (1997) theory is that people and environments can be classified into one or more types: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional (see Table 1 for a brief description of the six Holland types). Holland's theory assumes that most people can be classified into one or more of these six personality types based on their attitudes, competencies, and interest. Holland also describes six corresponding environments that correspond to the dominant personality type of individuals within that environment. For instance, an Investigative environment is dominated by people with an Investigative personality type. In Holland's theory, environment is equally important as personality in determining human behavior (Smart et al. 2000). The six environment types parallel the six personality types in regard to their focus on activities, competencies, perceptions, and values. In postsecondary education, a student's academic major is used as a proxy to represent an academic environment[1] in Holland's theory (Smart et al. 2000).

Holland hypothesizes that individuals are attracted to environments that correspond to their personality type, and in turn, these environments reinforce and reward different behaviors and values that are consistent with the dominant personality type in each environment. For instance, an Investigative environment emphasizes analytical or intellectual activities and encourages mathematical and scientific competencies. People in Investigative environments are rewarded for their display of scientific values and problem-solving skills. The hexagon model, presented in Fig. 1, provides a visual description of the similarity between types. Specifically, the hexagon summarizes the degree of psychological resemblance between types where types adjacent on the hexagon are more similar to one another. For example, the

[1] We use the term "academic environment" to refer specifically to the concept of environment in Holland's theory.

Table 1 Attributes of Holland's six personality types (adapted from Holland 1997)

Realistic types prefer activities that involve operating machines and tools; they tend to dislike educational and social activities. *Realistic* types also value material gains and perceive themselves as practical, conservative, and persistent. Others often see them as normal and frank. Example academic majors include Electrical Engineering, Mechanical Engineering, Occupational Safety and Health.

Investigative types prefer activities that have exploration, understanding, and prediction but avoid activities involving persuasion and sales. They value the acquisition of knowledge and scholarly achievements, and perceive themselves as critical, intelligent and skeptical but lacking interpersonal skills. Example academic majors include Biology, Chemistry, Mathematics, Physical Sciences.

Artistic types prefer literacy, musical, and artistic activities and dislike activities associated with following rules. *Artistic* types value aesthetic qualities and creativity. They see themselves as innovative, open, sensitive, and emotional. Others perceive them as unconventional, disorderly, and creative. Example academic majors include Architecture, Arts, Language/Literature, Music, Theatre/Drama.

Social types prefer activities associated with helping other individuals through personal interaction, and they often avoid mechanical and technical tasks. Social types perceive themselves as cooperative, empathetic, helpful, understanding, and lacking in mechanical ability. Others see them as agreeable, nurturing, and extroverted. Example academic majors include Early Childhood Education, Elementary/Middle School Education, Nursing, Social Work.

Enterprising types prefer to persuade and direct others to attain organizational and personal goals. They avoid scientific and intellectual topics. They value political and economic achievement, and they perceive themselves as self-confident, sociable, and possessing leadership ability. Others see them as energetic and outgoing. Example academic majors include Business Administration, Finance, Marketing, Media Studies.

Conventional type people prefer activities that involve the explicit, ordered, systematic manipulation of data and they avoid ambiguous and unstructured undertakings. They perceive themselves as careful, conforming orderly, as having clerical and numerical ability. They value material and financial accomplishment and power in social, business, and political arenas. Example academic majors include Accounting, Data Processing.

Investigative type is most similar to Realistic and Artistic types, which are adjacent to it on the hexagon, and least similar to the Enterprising type at the opposite side of the hexagon.

Three propositions are key to Holland's theory as it relates to college students and their academic majors: (1) Students choose academic environments (i.e., majors) compatible with their personality types (self-selection); (2) Academic environments reinforce and reward different patterns of behaviors, values, interests, and abilities (socialization); and (3) Students flourish in environments that are congruent, or similar, with their dominant personality types (congruence). Congruence between students' personality types and their academic environments is particularly important as Gottfredson and Holland (1996) argue, "individuals seek and remain in congruent environments; and environments recruit, retain, and reward congruent people" (p. 6). Our research focuses on Holland's third proposition: the congruence or fit between personality type and environment. Congruence, or person-environment fit, is assessed based on the degree of match between an individual's personality type and environment (Bowles 2008; Wiggins and Moody 1981).

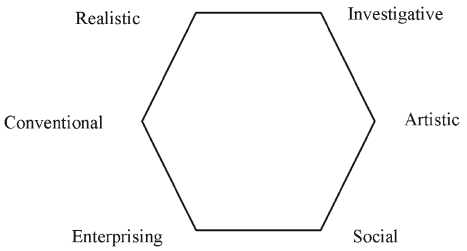

Fig. 1 Holland's RIASEC hexagon

Literature review

While Holland's theory has been applied extensively to study career development and vocational psychology (e.g., Gottfredson 1999; Holland 1997; Kang and Gottfredson 2015; Su et al. 2015), it has also been used to investigate the relationships between college students and their academic environments. Holland's theory has been used to examine the role played by academic environments on educational innovation and change (Lattuca et al. 2010) and to explore the impact academic environments have on students' interest and abilities (Smart and Feldman 1998). Researchers have also used Holland's theory to capture the variation in the learning patterns of college students across different academic environments (Smart et al. 2009) and to examine how the growth, achievement, and satisfaction of college students are affected by the congruence or fit between these students' personalities and their major field environments (Feldman et al. 2001, 2004).

Researchers have used Holland's self-selection proposition to study the factors that affect college major choice at entry and at graduation (Huang and Healy 1997; Porter and Umbach 2006; Smart and Feldman 1998). Porter and Umbach (2006) found that Holland personality types were some of the strongest predictors of students' academic major. Likewise, Smart et al. (2000) found evidence that students tend to select majors that are commensurate with their strongest interest and abilities and tended to avoid academic environments that reinforce and reward their weaker interest and abilities. Educational researchers have also found strong support for Holland's socialization proposition. Faculty play a significant role in the socialization process by rewarding students and reinforcing preferred values of the field through various teaching methods and emphasis on certain learning outcomes (Smart and Umbach 2007; Smart et al. 2009). For instance, Rocconi et al. (2015) investigated the relationship between Holland academic environments and college seniors' graduate degree aspirations. They observed that Holland academic environments not only were predictive of students' future educational plans but also moderated the influence of deep approaches to learning on degree aspirations, demonstrating the socializing influence disciplinary-based academic environments may have on students' future academic plans.

Research on the socializing assumption suggests that socialization occurs even if the person-environment fit is incongruent (Feldman et al. 2004, 2008; Smart et al. 2000). That is, even when a students' personality type differed from the dominant type in their academic environment, the academic environment still exerts an influence on students' growth and development in college. Smart et al. (2000) and Feldman et al. (2004, 2008) examined variation in the learning outcomes of students and consistently found that students in Holland academic environments gained in their interest and abilities related to that environment, regardless of whether personality type was congruent with that environment. For example, students in Investigative environments showed increases in their Investigative abilities and interest after 4 years of colleges, while students in non-Investigative environments declined in their Investigative interest and abilities, demonstrating the strong socializing influence academic environments can have on student development in college.

Research on Holland's third proposition—congruence or person-environment fit—has been less plentiful in higher education research and results have been mixed. Antony (1998) investigated how personality-career fit influenced initial medical career aspirations and found that congruence of one's personality type and environment was related to students' medical career aspirations. While examining the relationship between intended college major and students' expectations for college, Pike (2006) reported that "students' anticipated learning

outcomes were logically consistent with their personality types, and the relationship was strongest when personality types and intended majors were congruent" (p. 35). Other researchers have documented that congruence is associated with increased GPA (Horn 2004; Su 2012; Tracey and Robbins 2006), rates of retention (Allen and Robbins 2008; Tracey and Robbins 2006), and income after graduation (Su 2012). For example, Tracey and Robbins (2006) observed that students who were in majors that were similar to their ACT interest profile had higher GPAs than those whose interest-major match was lower. In addition, Su (2012) found congruence to be a powerful predictor of both college grades and income 11 years after high school graduation. However, the relationship between person-environment fit and academic achievement is mixed. For instance, research by Vahidi et al. (2016) did not demonstrate a link between person-environment fit and GPA for Malaysian students.

Both Smart et al. (2000) and Feldman et al. (2004) found support for the congruence assumption for students with Investigative, Artistic, and Enterprising personality types. Smart and colleagues noted that students with these personality types who entered academic environments congruent with their dominant personality type gained in their Investigative, Artistic, or Enterprising abilities and interests, whereas those with these personality types that entered academic environments not congruent with their dominant personality type remained the same or declined in those interest and abilities. However, Smart et al. (2000) did not find similar results for students in Social environments. Feldman et al. (2004) also examined whether congruent and incongruent students differed in their perceptions of and satisfaction with their college experience and did not find any differences in either perceptions or satisfaction among congruent and incongruent students within each of the four academic environments examined (i.e., Investigative, Artistic, Social, or Enterprising).

Person-environment fit has also been positively linked with a variety of work-related outcomes, including career persistence (e.g., Donohue 2006), job performance (e.g., Spokane et al. 2000), and personal adjustment (e.g., Lachterman and Meir 2004). Job satisfaction has been one of the most frequently examined vocational outcomes in the person-environment fit literature (Bowles 2008; Su et al. 2015). According to Holland's theory, individuals in congruent work environments are expected to experience a higher level of job satisfaction than those individuals who are in incongruent environments. However, the empirical evidence is mixed. Results from two meta-analyses demonstrate that person-work environment congruence is positively related to job satisfaction, but the effect size for these relationships tends to be small (e.g., $r < 0.20$) (Tranberg et al. 1993; Tsabari et al. 2005).

Research questions

The purpose of this study was to further test Holland's (1997) congruence proposition that students will flourish in academic environments (i.e., majors) that are congruent with their personality type. Two research questions guided the present research:

1. To what extent is congruence (i.e., person-environment fit) related to students' demographic characteristics and their personality types?
2. To what extent are students' grades, perceived learning gains, and satisfaction with college related to person-environment congruence, net the effects of student characteristics, and college experiences?

Our study of person-environment fit expands on previous research in several ways. First, prior studies (e.g., Smart et al. 2000; Feldman et al. 2004; Vahidi et al. 2016) have operationalized person-environment fit using students' dominant, or primary, personality type and dominant environment type often resulting in a dichotomous congruence measure. Our study takes a different approach. Rather than forcing students and environments into a single type (e.g., Realistic) and defining congruence based on the dominate type, we define congruence based on students' primary and secondary Holland types (e.g., Realistic-Investigative). Second, our study includes measures of all six Holland personality and environment types. Other researchers (e.g., Feldman et al. 2001, 2004; Rocconi et al. 2015; Smart et al. 2000) were unable to include all six types due to various data limitations, such as the absence of Conventional and Realistic environments. Third, we test Holland's congruence hypothesis on a generic measure of learning gains whereas prior research (e.g., Smart et al. 2000; Pike et al. 2012) utilizes learning outcomes specific to each Holland type. Finally, our study focuses on various aspects of student success (i.e., grades, perceived learning gains, and satisfaction) in order to test Holland's congruence assumption, which has not been thoroughly studied in postsecondary research.

Methods

Data source

Data for this study came from the 2015 National Survey of Student Engagement (NSSE). The NSSE is an annual survey administered to first-year and senior students at baccalaureate degree-granting colleges and universities across the USA. The NSSE is used to assess the extent to which students are exposed to and participate in a variety of effective educational practices (McCormick et al. 2013). The survey asks students about various aspects of their undergraduate experience, such as the time and effort they invest in their studies, their discussions and interactions with students who are different from themselves, their interactions with faculty members and students, and other educationally purposeful activities. NSSE data were used with permission from the Indiana University Center for Postsecondary Research.

In the 2015 NSSE administration, a set of items measuring students' personality type based on Holland's (1997) theory was asked of a subset of respondents. The item set consisted of questions that asked students to assess how much a characteristic described themselves as well as items that asked students how much they enjoyed certain types of activities. The use of self-reports to classify individuals by Holland personality type is well established, and the validity of these measures is well documented (Holland 1997). The item set was developed based on characteristics and activities that Holland claimed each trait will exhibit. A complete list of the items used to classify students based on personality type is presented in the Appendix Table 5.

Approximately 2400 first-year and 4000 senior students from twenty-one institutions answered the Holland item set. Because of our focus on person-environment fit, in which academic majors were used to operationalize environments in Holland's theory, we excluded first-year students from the analysis. We also excluded students who did not have an academic major (e.g., undecided) and students who had an academic major not classified into a Holland environment (e.g., general studies, multidisciplinary studies, other education). These exclusions reduced the analytic sample to 3350 senior students. Although missing data was not a major concern (i.e., less than 5% for any one variable), we employed a fully conditional

multiple imputation technique, in which we ran ten imputations (Allison 2002). Approximately, 67% of students were female. The racial-ethnic composition of the sample was as follows: 65% White, 8% Asian, 7% Black, 8% Latina/o, 8% multiracial, and 5% identified as other race-ethnicity. About half of the sample were first-generation students (i.e., neither parent has a bachelor's degree). Descriptive statistics are presented in Table 2.

Table 2 Descriptive statistics

	Mean	SD	Min	Max
Outcomes				
Self-reported grades (converted to GPA units)	3.45	0.506	1.67	4
Self-reported gains	64.16	23.480	0	100
Satisfaction	72.41	25.375	0	100
Person-environment fit				
Congruency index	1.52	1.452	0	5
Students' dominate Holland personality type				
Realistic personality type	0.19	0.390	0	1
Investigative personality type	0.15	0.362	0	1
Artistic personality type	0.19	0.393	0	1
Social personality type	0.13	0.339	0	1
Enterprising personality type	0.16	0.362	0	1
Conventional personality type	0.18	0.384	0	1
Dominate Holland academic environment				
Realistic environment	0.04	0.193	0	1
Investigative environment	0.35	0.476	0	1
Artistic environment	0.07	0.249	0	1
Social environment	0.31	0.461	0	1
Enterprising environment	0.19	0.394	0	1
Conventional environment	0.05	0.218	0	1
Student characteristics				
Female	0.67	0.471	0	1
Asian	0.08	0.267	0	1
Black	0.07	0.257	0	1
Latino	0.08	0.269	0	1
Other race	0.05	0.213	0	1
Multiracial	0.08	0.265	0	1
First-generation student	0.51	0.500	0	1
College experience measures				
Full-time student	0.78	0.413	0	1
STEM major	0.17	0.378	0	1
Transfer student	0.52	0.500	0	1
Lives on campus	0.11	0.307	0	1
Higher-order learning	42.67	13.943	0	60
Reflective and integrative learning	40.02	12.873	0	60
Learning strategies	42.06	14.397	0	60
Quantitative reasoning	30.74	17.327	0	60
Collaborative learning	32.06	15.041	0	60
Discussions with diverse others	42.07	15.752	0	60
Student-faculty interaction	23.46	16.185	0	60
Effective teaching practices	41.01	13.764	0	60
Quality of interactions	42.03	12.172	0	60
Supportive environment	31.70	14.872	0	60
Came to class unprepared	1.95	0.777	1	4
Challenging coursework	5.79	1.139	1	7
Time spent preparing for class	4.40	1.762	1	8
Time spent working on campus	1.77	1.534	1	8
Time spent working off campus	3.85	2.894	1	8

Measures

In order to measure person-environment fit, we first created variables representing Holland personality types and Holland environments. To assess students' personality type, responses to the Holland item set were scored using a graded response model (GRM). GRM scoring involved deriving a maximum likelihood score estimate based on the pattern of student's responses. Items that tap into the personality trait more effectively were given greater weight. The graded response model has been used for scale construction in a variety of studies in higher education (e.g., Kim and Sax 2014; Sharkness and DeAngelo 2011). GRM assumptions of unidimensionality and local independence were checked for each personality type. A personality profile was estimated for each student with the highest score representing a student's dominant personality type. Item parameter estimates are presented in the Appendix Table 5.

In postsecondary research, academic majors serve as a means of classifying students into Holland academic environments (Smart et al. 2000). As such, we used a students' reported academic major to operationalize the concept of environment in Holland's theory. Holland environment measures were derived by classifying major field of study into Holland environments using the *Dictionary of Holland Occupational Codes* (Gottfredson and Holland 1997). We used a two-digit Holland code (e.g., RI, SE), which represents the highest and second highest Holland type, for each personality and environment measure.

In Holland's theory, person-environment fit refers to the compatibility between individuals and their environment. In the present study, person-environment fit was operationalized based on the degree of similarity between a student's personality type and his or her academic environment (i.e., major). Using the personality type and environment measures, person-environment fit was measured on a 6-point scale using a modified version of Wiggins and Moody's (1981) congruency index: 0 = no congruence in personality and environment types (e.g., RI, SC), 1 = one letter similar but in a different position (e.g., RI, IC), 2 = primary type different but secondary type congruent (e.g., RI, CI), 3 = primary type congruent but secondary type different (e.g., RI, RE), 4 = two same letters in different positions (e.g., RI, IR), 5 = perfect congruence in primary and secondary Holland codes (e.g., RI, RI). For example, a student with a Social-Investigative (SI) personality type majoring in a Social-Investigative environment (e.g., Nursing) received a 5 on the person-environment fit measure. A student with a SI personality type majoring in an Investigative-Social environment (e.g., nutrition) received a 4 on the person-environment fit measure. A student with a SI personality type majoring in a Social-Enterprising environment (e.g., political science) received a 3 on the person-environment fit measure. A student with a SI personality type majoring in a Realistic-Investigative environment (e.g., mechanical engineering) received a 2 on the person-environment fit measure. A student with a SI personality type majoring in an Investigative-Realistic environment (e.g., computer science) received a 1 on the person-environment measure. A student with a SI personality type majoring in a Conventional-Enterprising environment (e.g., accounting) received a 0 on the person-environment fit measure.

Three outcome measures were included in the study. First, GPA was estimated using students' self-reported grades. Cole et al. (2012) found a high degree of correspondence between self-reported and actual grades. This finding is consistent with earlier research by Baird (1976) and Valiga (1986). In addition, Baird (1976) found that students accurately reported grades, even when there were strong incentives to be inaccurate.

Second, responses to ten questions from the NSSE survey dealing with gains made during college were summed to create a measure of perceived learning gains. These items asked students how much their institution contributed to their knowledge, skill, and personal development in the following areas: writing clearly and effectively, speaking clearly and effectively, thinking critically and analytically, analyzing numerical information, acquiring work-related knowledge and skills, working effectively with others, developing a personal code of values and ethics, understanding people of other backgrounds, solving complex real-world problems, and being an informed and active citizen. Alpha reliability for this scale was 0.89.

Some researchers have raised questions about the use of self-reported gains in learning and development (Bowman 2011; Porter 2011); however, other research has supported the use of self-reported gains in research on college students. For example, studies by Berdie (1971), Dumont and Troelstrup (1980), and Pohlmann and Beggs (1974) examined the relationships between self-reports of learning and objective measures of knowledge and ability across similar domains. All three studies found moderate positive correlations between self-reports and objective test scores. Pike (1995, 1996) examined the relationships between self-reported learning and standardized test scores and found modest, but consistent, positive associations between self-reports and test scores. Astin (1977), Baird (1976), and Pace (1984, 1985) found that program of study and self-reported learning were significantly related in logically consistent ways. In a series of studies, Pike and colleagues (Pike 2011; Pike et al. 2012) examined the relationships between major field and self-reports of learning using Holland's (1997) theory applied to academic environments. Relationships they found were stronger than in earlier studies, possibly because of the predictive utility of Holland's theory.

The third outcome, satisfaction with college, was represented by the sum of responses to two questions: (1) How would you evaluate your entire educational experience at this institution? (2) If you could start over again, would you go to the same institution you are now attending? Alpha reliability for this measure was 0.81.

We also include an array of control variables in order to assess the effects of person-environment fit on grades, perceived gains, and satisfaction above and beyond the effects of the usual demographic and college experience measures. Student background characteristics were represented by sex (being female), six dummy variables for race-ethnicity (with White as the reference group), and first-generation status. College experience measures included enrollment status, transfer status, living on campus, and majoring in a STEM field. The 10 NSSE engagement measures were also included as measures of college experiences. Each engagement measure is a reliable scale that measures a distinct aspect of student engagement by summarizing students' responses to a set of related survey questions. They include four measures of academic challenge (alpha reliabilities in parentheses): Higher-Order Learning ($\alpha = 0.91$), Reflective and Integrative Learning ($\alpha = 0.92$), Learning Strategies ($\alpha = 0.84$), and Quantitative Reasoning ($\alpha = 0.92$); two measures about learning with peers: Collaborative Learning ($\alpha = 0.86$) and Discussions with Diverse Others ($\alpha = 0.93$); two measures describing experiences with faculty: Student-Faculty Interaction ($\alpha = 0.88$) and Effective Teaching Practices ($\alpha = 0.90$); and two measures of the campus environment: Quality of Interactions ($\alpha = 0.79$) and Supportive Environment ($\alpha = 0.92$). The psychometric properties of these measures have been described in detail elsewhere (Brckalorenz and Gonyea 2014; Miller et al. 2016). Responses to questions about time spent preparing for class, challenging coursework, coming to class unprepared, and working for pay were also included.

Data analysis

The data analysis was conducted in two phases. For all analyses, we utilized fixed effects regression models which included fixed effects for institutions and standard errors adjusted for the clustering of students within institutions (Angrist and Pischke 2009). In order to answer the first research question examining the relationship between student characteristics and person-environment fit, we regressed person-environment fit on student background characteristics (e.g., sex, race-ethnicity, first-generation status) and personality type. The second phase examined the relationship between the three outcome measures (e.g., self-reported grades, perceived learning gains, and satisfaction) and person-environment fit, net the effects of student background and college experiences. Preliminary results indicated that heteroscedasticity was a significant issue in both phases of the analysis (Cook and Weisberg 1983). In addition, design effects (Muthén and Satorra 1995) for the models in the second phase were well above 2.00, indicating that the clustering of students within institutions would lead to type I errors. To counteract these problems, clustered robust standard errors were utilized (Angrist and Pischke 2009; StataCorp 2014). An examination of the variance inflation factors revealed that multicollinearity was not an issue in any of the analyses.

Limitations

As with any research, ours is not without its limitations. Care should be taken not to over generalize the results of this study. Our sample is a convenience sample of twenty-one institutions that self-selected to participate in the NSSE, and it is not necessarily representative of all 4-year institutions in the USA. Institutions elect to participate in the NSSE for a variety of reasons, mainly for institutional improvement, which may affect the context of the student experience. This study also relies on self-reported behaviors, which may not be completely objective. Another limitation is the cross-sectional nature of the research. The NSSE is a snapshot in time, and as such, it cannot fully depict students' undergraduate experience. While the results should be interpreted with caution, the strengths of this study outweigh the limitations.

Results

Results from the first analysis (Table 3) revealed that student characteristics were significantly related to person-environment fit. Student demographics (sex, race-ethnicity, and first-generation status) accounted for 2% of the variance in person-environment fit, and personality type accounted for an additional 6% of the variance. An examination of the coefficients in the model revealed that being female or Asian was negatively related to person-environment fit. Other racial groups and first-generation status were not significantly related to fit. Compared with Realistic personality types, Investigative, Social, and Enterprising types had significantly higher levels of person-environment fit, whereas students with Conventional personality types had significantly lower levels of fit.

Results for the second phase of the data analysis (Table 4) revealed that congruence, student background characteristics, and college experiences were significantly related to self-reported grades and accounted for approximately 13% of the variance in the self-reported grades measure. Consistent with Holland's theory, person-environment fit was moderately and

Table 3 Relationships between person-environment fit and student characteristics

Variable	*b* (se)	*β*	*b* (se)	*β*
Female	−0.242*** (0.048)	−0.078	−0.164** (0.051)	−0.053
Asian	−0.214** (0.069)	−0.039	−0.169* (0.069)	−0.031
Black	0.048 (0.075)	0.008	0.025 (0.085)	0.004
Latina/o	−0.134 (0.082)	−0.025	−0.098 (0.072)	−0.018
Other race	0.016 (0.077)	0.002	0.045 (0.083)	0.007
Multiracial	−0.019 (0.096)	−0.004	−0.002 (0.091)	0.000
First-generation	−0.047 (0.047)	−0.016	−0.026 (0.040)	−0.009
Artistic			−0.018 (0.108)	0.005
Social			0.553** (0.158)	0.129
Enterprising			0.420* (0.162)	0.105
Conventional			−0.311** (0.089)	−0.082
Investigative			0.700*** (0.104)	0.174
Constant	1.72*** (0.056)		1.46*** (0.094)	−0.053
R^2	0.020		0.077	

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. *b*, unstandardized coefficient; *se*, standard error; *β*, standardized coefficient

positively related to self-reported grades ($\beta = 0.05$). Relative to White students, being a member of any other racial or ethnic group, beside Asian and multiracial, was negatively related to the grades measure. Being a first-generation student was negatively related to grades, as was being a STEM major. Three of the engagement indicators—higher-order learning, reflective and integrative learning, and quality of interactions—were positively related to self-reported grades, as was the amount of time students reported spending preparing for class. On the other hand, coming to class unprepared and working off campus were negatively related to self-reported grades.

Although strong relationships were observed between perceived learning gains and both student characteristics and college experiences ($R^2 = 0.53$), person-environment fit was not significantly related to perceived gains in learning during college. Similarly, satisfaction with college was significantly related to student background characteristics and college experience measures, and these relationships were quite strong ($R^2 = 0.46$). Here again, person-environment fit was not significantly related to satisfaction. To more fully examine the relationship person-environment fit may have with satisfaction and perceived learning gains, we also ran models including pairwise comparison among levels of congruence (e.g., perfect congruence compared with the other categories) and did not find any statistically significant differences among levels of congruence for either satisfaction or perceived learning gains.

Discussion

Previous research using Holland's theory has consistently found that students tend to select academic environments that are consistent with their personality types and that those environments tend to reinforce and reward specific sets of attitudes and abilities (Smart et al. 2000). Holland's third proposition that individuals flourish in environments that are congruent with their personality types has important implications for student learning and success in college. However, fewer studies have focused on Holland's third, person-environment fit, proposition as it relates to college student development. The results of the present research provide limited

Table 4 Relationships between education outcomes and person-environment fit, student characteristics, and college experiences

Variable	Grades		Gains		Satisfaction	
	b (se)	*β*	*b* (se)	*β*	*b* (se)	*β*
Person-environment fit	0.017** (0.005)	0.050	0.227 (0.150)	0.014	0.339 (0.265)	0.019
Female	0.043* (0.017)	0.040	0.012 (0.607)	0.001	0.411 (0.912)	0.007
Asian	−0.052 (0.026)	−0.028	2.414* (1.040)	0.028	−0.341 (1.884)	−0.004
Black	−0.324*** (0.031)	−0.164	1.934 (1.235)	0.021	−4.126** (0.989)	−0.042
Latina/o	−0.132** (0.036)	−0.070	5.122*** (0.644)	0.058	−0.795 (1.810)	−0.009
Other race	−0.153* (0.061)	−0.063	0.826 (1.339)	0.008	−2.696 (1.933)	−0.023
Multiracial	−0.055 (0.029)	−0.028	1.735 (1.374)	0.020	0.286 (1.099)	0.003
Full-time	−0.006 (0.038)	−0.005	3.469* (1.510)	0.061	0.648 (0.834)	0.011
First-generation	−0.092*** (0.017)	−0.091	1.223 (0.878)	0.026	2.270* (0.924)	0.045
STEM major	−0.102* (0.044)	−0.075	−2.483** (0.831)	−0.039	−2.820** (0.820)	−0.042
Transfer	0.021 (0.028)	0.021	−02.277* (1.010)	−0.049	−0.475 (1.028)	−0.009
Live on campus	0.074* (0.032)	0.045	0.472 (1.769)	0.007	1.660 (1.168)	0.021
Higher-order learning	0.002*** (0.001)	0.066	0.199*** (0.028)	0.118	0.046 (0.025)	0.026
Reflective and integrative learning	0.002* (0.001)	0.045	0.225*** (0.034)	0.123	0.066 (0.045)	0.033
Learning strategies	0.001 (0.001)	0.024	0.027 (0.036)	0.017	−0.042 (0.034)	−0.024
Quantitative reasoning	0.000 (0.001)	−0.015	0.123*** (0.021)	0.092	−0.001 (0.021)	0.000
Collaborative learning	−0.001 (0.001)	−0.022	0.085** (0.027)	0.054	−0.075 (0.055)	−0.045
Discussions with diverse others	0.000 (0.001)	−0.012	−0.015 (0.024)	−0.010	−0.023 (0.026)	−0.015
Student-faculty interaction	0.001 (0.001)	0.020	0.060** (0.021)	0.042	0.030 (0.029)	0.018
Effective teaching practices	−0.001 (0.001)	−0.017	0.168*** (0.029)	0.099	0.291*** (0.041)	0.158
Quality of interactions	0.004* (0.001)	0.087	0.251*** (0.034)	0.131	0.695*** (0.047)	0.335
Supportive environment	0.001 (0.001)	0.024	0.454*** (0.028)	0.286	0.352*** (0.029)	0.206
Came to class unprepared	−0.062*** (0.013)	−0.095	−0.301 (0.331)	−0.010	−1.071* (0.390)	−0.033
Challenging coursework	−0.018 (0.011)	−0.042	3.258*** (0.324)	0.157	2.463*** (0.223)	0.110
Preparing for class	0.028*** (0.006)	0.097	−0.672* (0.247)	−0.051	−0.099 (0.205)	−0.007
Working on campus	−0.003 (0.007)	−0.008	−0.343 (0.211)	−0.023	−0.055 (0.363)	−0.003
Working off campus	−0.009* (0.003)	−0.050	0.193 (0.125)	0.024	−0.156 (0.211)	−0.018
Constant	3.32*** (0.112)		−12.16** (3.822)		−7.54 (3.863)	
R^2	0.126		0.525		0.458	

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. *b*, unstandardized coefficient; *se*, standard error; *β*, standardized coefficient

support for this proposition. Congruence between personality type and academic environment was positively related to grades in college, but not perceived gains in learning or satisfaction.

The fact that person-environment fit had a positive relationship with students' grades is not surprising and confirms prior research, which has demonstrated a modest relationship between person-environment fit and academic achievement (e.g., Horn 2004; Su 2012; Tracey and Robbins 2006). Holland (1997) argues that academic environments reward students who exhibit the attitudes and abilities valued in the environments. Students whose personality types are congruent with the environment are most likely to exhibit the attitudes and ability valued in a given academic environment. Grades, many of which are awarded by faculty who are part of the academic environment, are an obvious reward for appropriate behavior.

While the lack of relationship between person-environment fit and self-reported learning gains contradicts Holland's congruence assumption, it is not too surprising. The absence of a significant effect for person-environment fit may reflect the strength of the socializing effect of academic environments—Holland's second proposition. Previous research (e.g., Feldman et al. 2004; Pike et al. 2012; Smart et al. 2000) documents that academic environments produce substantial gains among students, irrespective of whether their personality types are congruent with the environment. In light of our findings and prior research on the strong socialization influence of academic environment, perhaps person-environment fit is not a main determinate of perceived growth in college.

The absence of a positive relationship between person-environment fit and perceived learning gains may also be attributable to the fact that the gains measure used in this study represented generic learning outcomes. Smart and colleagues (Smart et al. 2000, 2009) suggest that what students ultimately learn and the ways faculty members socialize students to attain different learning outcomes will vary depending on the academic environment. This suggests that high levels of person-environment fit may have enhanced learning outcomes, but the types of learning that occurred would be different for each type of environment. For instance, prior research (e.g., Smart et al. 2000; Feldman et al. 2004; Pike et al. 2012) has found that membership in a Holland academic environment is positively related to learning outcomes corresponding to that particular environment type. Smart et al. (2000), for example, found that students with a dominant Investigative personality type who entered a congruent (i.e., Investigative) academic environment reported more growth on items consistent with Holland's descriptions of Investigative types than did their counterparts in incongruent academic environments. However, Smart and colleagues' findings for the congruence proposition were mixed. Specifically, they did not find differences in scores between congruent and incongruent Social students on their Social interest and abilities scales. Because academic environments reward and encourage different behaviors and learning, it may be unrealistic to expect a generic measure of learning gains to capture the salient learning aspects of each environment.

We also did not find support for Holland's congruence proposition in terms of students' satisfaction with their college experience. A central tenant of Holland's theory is that individuals will be satisfied and will want to remain in environments that are congruent with their personality types. Thus, students in incongruent environments might be more negative in their satisfaction of their college experience. In this research, that was not the case. Despite not confirming Holland's (1997) congruence proposition, our results agree with findings from Feldman et al. (2004) who observed similar levels of satisfaction and discontent among students in congruent and incongruent environments. Moreover, research examining person-work environment fit and job satisfaction has typically only demonstrated a weak relationship between congruence and job satisfaction (Tranberg et al. 1993; Tsabari et al. 2005). Perhaps

results regarding person-environment fit and satisfaction would more closely align with Holland's proposition if the questions dealt with satisfaction with the major field of study rather than satisfaction with the college experience.

The logic of Holland's theory indicates that students who enter congruent academic environments are more likely to be satisfied and more successful in college, while those who enter incongruent environments are likely to be less satisfied and less successful. However, our results suggest that students who enter incongruent academic environments may not be less satisfied or learn less. Our findings show that students in incongruent environments report similar levels of learning gains and satisfaction with their college experience as students in congruent environments, suggesting that students who enter incongruent environments may not be at such a disadvantage. These results could prove fruitful for students with a Realistic or Conventional personality type where there are limited congruent academic environments available on 4-year college campuses.

It is also important to note that students' demographic characteristics have little to do with the selection of academic environments that are congruent with their personality types. However, person-environment fit was significantly related to students' personality types. In the present research, having a dominant Investigative, Social, or Enterprising personality type was positively related to congruence, compared with a Realistic personality type. Although it is tempting to assume that students' personality types are the impetus behind person-environment fit, as mentioned above, it is equally likely that environments exert substantial influence on congruence. Investigative, Artistic, Social, and Enterprising environments include large numbers of possible majors, but Realistic and Conventional environments include relatively few majors. Thus, person-environment fit may depend on the availability of major fields of study as much as it depends on the personality types of students.

The findings of this study have practical and policy implications for student affairs professionals and institutional leaders. For those who assist and advise students in selecting an academic major, findings from this study and previous research suggest that considering personality-environment fit may be beneficial to students' success in college, particularly grades. The traditional approach to applying Holland's theory in college and university settings has been to advise students to select an academic major or career that is congruent with their personality type (Reardon and Bullock 2004). While this approach is straightforward, it ignores the other aspects of Holland's theory, notably that environments will reinforce and reward certain behaviors, interests, and abilities (i.e., the socialization assumption). Our research and the research of others (e.g., Feldman et al. 2004) indicate that students in fields incongruent with their personality type fared as well as those in congruent environments, especially in terms of their satisfaction with the institution and perceived learning gains. Thus, it may not be as detrimental as previously assumed to enter an academic environment incongruent with one's personality type.

Conclusions

This study set out to test a primary proposition of Holland's (1997) theory, as applied in educational settings. Holland's theory suggests that educational achievement and satisfaction are contingent on the congruence or fit between one's personality type and their educational environment. Results indicated mixed findings regarding Holland's congruence proposition.

We found that person-environment fit is positively related to self-reported grades but not significantly related to either perceived learning gains or satisfaction. Although the results were not as expected, they demonstrate that students in environments not congruent with their personality type may have similar levels of satisfaction and perceived learning gains. Thus, students in incongruent environments appear to have collegiate experiences comparable with their peers in congruent environments and may not be at a distinct disadvantage.

Appendix

Table 5 Graded response model estimates and factor loadings (in parentheses) for items measuring Holland's personality type

Item	α	β_1	β_2	β_3	β_4
Realistic					
How much do you enjoy doing the following? *Not at all, Very little, Some, Quite a bit, Very much*					
• Working outdoors (0.80)	3.35	−2.04	−1.25	−0.33	0.51
• Being physically active (0.54)	1.28	−3.64	−2.15	−0.50	0.71
• Operating tools and machinery (0.42)	0.88	−2.22	−0.46	1.15	2.54
Investigative					
How much do the following words describe you? *Not at all, Very little, Some, Quite a bit, Very much*					
• Logical (0.48)	1.03	−6.18	−4.16	−1.73	0.47
How much do you enjoy doing the following? *Not at all, Very little, Some, Quite a bit, Very much*					
• Solving complex puzzles (0.70)	2.15	−2.16	−1.26	−0.09	0.91
• Being challenged academically (0.54)	1.26	−4.58	−3.32	−1.36	0.30
• Solving math problems (0.54)	1.29	−1.58	−0.55	0.50	1.62
Artistic					
How much do the following words describe you? *Not at all, Very little, Some, Quite a bit, Very much*					
• Artistic (0.77)	2.46	−1.56	−0.58	0.42	1.21
• Imaginative (0.75)	2.70	−2.65	−1.49	−0.37	0.55
• Creative (0.87)	4.39	−2.11	−1.13	−0.21	0.58
How much do you enjoy doing the following? *Not at all, Very little, Some, Quite a bit, Very much*					
• Participating in an art exhibit, play, or arts performance (dance, music, etc.) (0.54)	1.20	−1.56	−0.35	0.71	1.62
• Being spontaneous (not being restricted by a plan or schedule) (0.36)	0.78	−5.12	−2.66	−0.37	1.42
• Expressing yourself creatively (0.84)	3.22	−2.00	−1.04	−0.11	0.64
Social					
How much do the following words describe you? *Not at all, Very little, Some, Quite a bit, Very much*					
• Sociable (0.47)	1.03	−4.62	−2.68	−0.59	1.00
• Helpful (0.67)	1.92	−4.50	−3.21	−1.52	0.16
• Patient (0.38)	0.83	−4.74	−2.67	−0.56	1.27
How much do you enjoy doing the following? *Not at all, Very little, Some, Quite a bit, Very much*					
• Working in groups (0.46)	1.02	−3.07	−1.55	0.24	1.89
• Caring for the health or well-being of others (0.65)	1.75	−2.98	−1.89	−0.70	0.36
• Helping people with their problems (0.67)	1.96	−3.21	−2.13	−0.78	0.48
Enterprising					
How much do the following words describe you? *Not at all, Very little, Some, Quite a bit, Very much*					
• Persuasive (0.66)	1.71	−3.32	−1.76	−0.12	1.27
• Ambitious (0.53)	1.27	−4.38	−2.79	−1.01	0.43
• Assertive (0.62)	1.63	−2.97	−1.52	−0.11	1.18
How much do you enjoy doing the following? *Not at all, Very little, Some, Quite a bit, Very much*					
• Leading a group (0.68)	1.83	−2.67	−1.64	−0.40	0.76
• Making connections with important people (0.58)	1.39	−3.39	−1.95	−0.49	0.78
• Persuading people to do things your way (0.57)	1.38	−2.85	−1.13	0.50	1.81

Table 5 (continued)

Item	α	β_1	β_2	β_3	β_4
Conventional					
How much do the following words describe you? *Not at all, Very little, Some, Quite a bit, Very much*					
• Detail-oriented (0.60)	1.73	−3.73	−2.39	−0.91	0.40
• Careful (0.46)	1.08	−5.40	−3.28	−1.14	0.70
• Organized (0.69)	1.86	−3.07	−1.91	−0.65	0.45
How much do you enjoy doing the following? *Not at all, Very little, Some, Quite a bit, Very much*					
• Following directions (0.57)	1.43	−3.40	−2.03	−0.21	1.38
• Being responsible for details (0.76)	2.62	−2.79	−1.72	−0.56	0.67
• Organizing information (0.71)	1.95	−3.21	−1.98	−0.64	0.62

Discrimination parameters (α) indicate how well an item taps into the underlying construct, > 1.7 very high, 1.35–1.7 high, 0.65–1.34 moderate. Threshold parameters (β) are on a *z*-score metric and indicate the point on the latent trait (i.e., personality type) at which a respondent has a 50% of the probability of responding to an item in a certain category or above (for more information on GRM, see Sharkness and DeAngelo 2011)

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