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The effects of college major and job field congruence on job satisfaction ☆

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Abstract

This study investigated predictors of job satisfaction and builds on previous research on the effects of bachelor's degree majors and job field congruence on job satisfaction. Data on workers' job experiences in 2001 were matched to those workers' college experiences across 30 institutions and background characteristics up to 25 years earlier. With statistical controls for demographic, socioeconomic, and academic characteristics, a final sample of 2515 college graduates was used to test hypotheses centered on the possibility that a causal order relates education and job satisfaction. Specifically, college degree majors, measures of both actual and perceived congruence, as well as income were examined in relation to three dimensions of job satisfaction. Results support hypotheses that income and congruence both mediate the effects of majors on job satisfaction, and identify that two different measures of congruence are causally related to intrinsic dimensions of job satisfaction.

Keywords: Job satisfaction; Congruence; College majors; Career outcomes of college

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1. Introduction

The ability to make more money and get a better job is of primary importance in students' decisions to enter college (Astin, 1993). Past studies have shown that significant monetary returns accompany higher education degree attainment as well as academic choices such as major field of study (Leslie & Brinkman, 1988; Pascarella & Terenzini, 1991; Pascarella & Terenzini, in press), and that the college experience fosters "concern with intrinsic returns from careers" (Bowen, 1977, p. 436). However, it is not clearly understood how specific college experiences affect the acquisition of better, more intrinsically rewarding work experiences (Leslie & Brinkman, 1988).

There is considerable evidence from the field of sociology that job satisfaction exists within a causal order, both as an outcome in itself and as a determinant of other important attitudes and behaviors (Kalleberg, 1977; Locke, 1976). As an outcome, research has indicated that individuals' job satisfaction is likely determined directly by their work-related income and indirectly by their education (Agho, Mueller, & Price, 1993; Glenn & Weaver, 1982; Locke, 1976; Ross & Reskin, 1992). In addition, higher education scholars and economists of education have clearly and consistently demonstrated that college major and the extent to which there is "a generally close and functional link to occupations" (Pascarella & Terenzini, in press, p. 113), significantly effect labor market earnings (Grubb, 1992; Rumberger & Thomas, 1993; Thomas, 2000, 2003). Net of education attainment and other confounding influences, Grubb (1992), Rumberger and Thomas (1993), and Thomas (2000, 2003) found that individuals who majored in subjects with a quantitative or scientific orientation (such as business, health, math, science, and engineering fields) enjoyed significantly greater earnings once in the labor market. Based on their literature review, Pascarella and Terenzini (in press) recently identified that choice of major may lead to as much as a 25–35% advantage in earnings depending on field of study. Together, this evidence suggests a causal order where income is an important determinant of job satisfaction, but where the effect of income may vary across majors and with the extent to which majors and job fields are related.

Three previous studies have explicitly examined the relationship between college majors and job satisfaction, each incorporating Holland's (1985, 1997) theory of vocational behavior (Elton & Smart, 1988; Fricko & Beehr, 1992; Smart, Elton, & McLaughlin, 1986). In brief, Holland's theory organizes vocational preferences into six categories of interests and work environments (Realistic, Investigative, Artistic, Social, Enterprising, and Conventional). Related to educational and occupational histories, the congruence between individuals' interests and environments affects the degree of continuity in their occupational decisions, which in turn influences success and satisfaction on the job (Holland, 1997). Several studies have found that, over time, stable educational and work histories lead to favorable vocational outcomes (Barak & Rabbi, 1982; Gottfredson, 1977; Nafziger, Holland, Helms, & McPartland, 1974; Oleski & Subich, 1996). Accordingly, the closer the fit (or greater the congruence) between an individual's major and subsequent job field, the more satisfied they should feel with their work experience. Beyond these general concepts,

however, researchers have taken numerous approaches to measuring congruence between majors and job fields as well as estimating the effects of congruence on job satisfaction.

The first of these efforts to relate college majors, job fields, and job satisfaction was Smart et al.'s (1986) analysis of Cooperative Institutional Research Program (CIRP) data covering college and university students up to 5 years after graduation. Smart et al. examined college majors and job satisfaction to test the hypothesis advanced by Holland's theory of a positive relationship between major–job field congruence and job satisfaction. Congruence was measured by responses to the question "Is your current or most recent job related to your last undergraduate major?" on a three-point scale from "no, not related" to "yes, closely related." In addition, 68 undergraduate majors were organized according to Holland's six primary types, and three factorially derived scales were used to represent overall, extrinsic, and intrinsic job satisfaction.

Elton and Smart (1988) also examined CIRP data to test the same hypothesis as Smart et al. (1986). Using data that spanned a 9-year period, Elton and Smart studied the relationship between congruence, work environment, and extrinsic dimensions of job satisfaction. Congruence was constructed according to the degree to which perfect matches occurred between occupational aspirations of respondents as college freshman in 1971, their undergraduate majors, and their actual jobs in 1980.

Most recently, Fricko and Beehr (1992) analyzed students from one university who had been working, on average, less than 2 years. Job satisfaction was captured through mean scores among five questions related to general job satisfaction and congruence was measured using three distinct techniques. One of the measures was constructed based on gender-normed relationships between Strong–Campbell Interest Inventories (SCII) that participants completed at their freshman orientation and their corresponding General Occupational Themes, both coded according to Holland's types. A second measure of congruence was constructed based on college majors and occupations, according to three-letter Holland codes and built into a nine-point continuous scale. Finally, a measure of perceived congruence was based on the question "My job is in the same field as my college major" and answered on a seven-point scale ranging from "strongly disagree" to "strongly agree."

By empirically estimating the effects of congruence on job satisfaction, Smart et al. (1986), Elton and Smart (1988), and Fricko and Beehr (1992) each found evidence that major–job field congruence is positively related to job satisfaction. However, each study employed different analytical methods and incorporated different measures of congruence to estimate different dimensions of job satisfaction (such as intrinsic, extrinsic, or overall job satisfaction), making generalizations problematic. While each study was longitudinal, none used congruence to test a causal relationship between majors and job satisfaction, nor did any of the studies sufficiently control for confounding effects of differences in individual background characteristics. And, with the exception of the Fricko and Beehr (1992) study, past research on major–job field congruence has failed to account for the influence of work-related income. Given the evidence that income is an important predictor of job

satisfaction, to understand the unique effects of majors and congruence on job satisfaction it is essential to control for the confounding effects of income.

Together, the above research suggests an overall causal model of job satisfaction, where major field of study, major–job field congruence, and income each has a direct effect. Congruence may also have an effect on job satisfaction that is mediated by income, while major field of study may have an effect on job satisfaction that is mediated by both congruence and income. Fig. 1 illustrates this model.

In this study, focusing on the relationship between major field of study during college and ensuing levels of job satisfaction, we tested the possibility that a causal process relates college majors and different dimensions of job satisfaction. Using longitudinal data covering a wide range of individual-level background characteristics as well as college and work experience characteristics of college graduates from 1976–78, 1984–86, and 1994–96, we estimated the unique effects of college majors on job satisfaction using several different models. This study adds to the work of Smart et al. (1986), Elton and Smart (1988), and Fricko and Beehr (1992) by investigating the congruence between majors and job fields as predictors of job satisfaction, and extends past research by examining if a causal order may explain how an individuals' college major may lead to a more personally rewarding work experience.

Our primary hypothesis was that an overall causal order relates college majors and job satisfaction. We predicted that quantitative, skill-based majors (such as math, engineering, business, and health sciences) would directly affect income in a manner consistent with past research, while also having an indirect effect on job satisfaction that is mediated by income. We also predicted a positive relationship between major–job field congruence and job satisfaction in general.

Based on research by Spokane (1979) and Spokane and Derby (1979) we also explored the possibility that distinct measures of congruence may affect job satisfaction in different ways. Spokane (1979) and Spokane and Derby (1979) found actual (or constructed) congruence between students' interests and majors to be significantly related to their perceptions of congruence. This seemingly logical finding has potentially important implications for studying congruence as a determinant of job satisfaction, as well for interpreting previous research. Accordingly, we tested whether or not actual congruence may have a direct effect on job satisfaction, as well as an indirect effect mediated by perceptions of congruence.

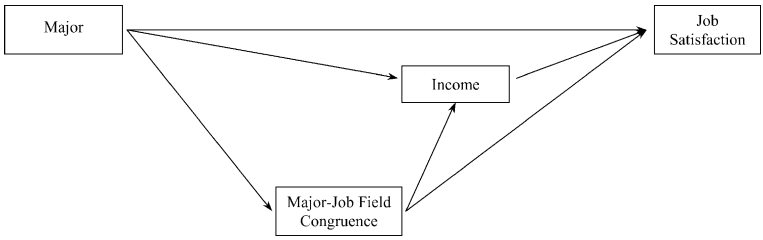

Fig. 1. Causal model relating college majors and job satisfaction.

2. Methods

2.1. Data

Our data consisted of information provided by alumni from 30 private and public colleges in the Appalachian Region, collected in 2001 with the purpose of studying the effects of a small group of liberal arts colleges on the personal and occupational lives of their graduates. An Alumni Survey was used to collect information on current work experiences and retrospective college experiences of 3 cohorts of alumni (the classes of 1974–76, 1984–86, and 1994–96) from 20 religiously affiliated liberal arts colleges located in Central Appalachia, 5 public regional institutions also located in Central Appalachia, and 5 liberal arts colleges both in and out of Central Appalachia that instituted a work program for their student body. These data were then matched to information from the ACT Assessment that the participants took prior to college, providing data on their ACT scores, high school accomplishments, demographic characteristics, and educational aspirations.

All of our analyses were based on only those alumni who received a bachelor's degree from the institution that requested their participation in the Alumni Survey, and who, as of 2001, had not completed any additional education degree or certification program. This was done to improve the accuracy by which congruence between college major and job field could be measured by minimizing the intervening experiences that occurred between graduating from college and completing the Alumni Survey. Excluding participants with any missing data, this criterion provided a final sample of 2515 alumni, the slight majority of which were women (54% or 1358) and nearly all of which were white (97% or 2440).

To adjust for potential response bias, we weighted the data to better represent the population of alumni by sex and institution, within each graduation cohort. Using figures provided by ACT, Inc., on student characteristics at the participating institutions during each of the three graduation cohorts, a sample-weighting algorithm was developed. For example, if an institution had 200 women graduate between 1994 and 96, and we only had 100 women from that institution and that cohort in our sample, data representing those particular female graduates were given a weight of 2.00. While such a weighting procedure cannot adjust for non-response bias, it did make the sample analyzed more representative of the estimated population of alumni by sex, institution, and graduation cohort. All analyses were based on weighted data, partially described in Table 1. Descriptive statistics of the complete set of variables are available upon request.

2.2. Model

$$Income = f(a,\ Major,\ Congruence,\ z), \tag{1}$$

$$Job\ satisfaction = \delta(a,\ Income,\ Major,\ Congruence,\ z), \tag{2}$$

Table 1
Mean, range, and standard deviation of variables used in analyses of alumni of job satisfaction

	Mean	Minimum	Maximum	*SD*
College majors				
Arts and Humanities	.12	.00	1.00	.33
Business	.24	.00	1.00	.43
Education	.18	.00	1.00	.38
Health sciences	.11	.00	1.00	.31
Math/Computer Science/Engineering	.05	.00	1.00	.21
Sciences	.07	.00	1.00	.26
Social Sciences	.14	.00	1.00	.35
Technical	.09	.00	1.00	.29
Characteristics of college attended and alumni grades				
Private college	.56	.00	1.00	.50
Public college	.31	.00	1.00	.46
Work college	.14	.00	1.00	.34
Selectivity of institution attended (average ACT composite)	21.39	18.91	23.62	1.04
Grades	5.68	3.00	7.00	.97
Major–job field congruence				
Actual major–job field congruence	3.97	1.00	5.00	1.30
Perceived major–job field congruence	3.06	1.00	4.00	1.16
Employment characteristics				
Employed full-time	.86	.00	1.00	.34
Employed at a for-profit organization	.46	.00	1.00	.50
Work in Appalachia	.51	.00	1.00	.50
Employment outcomes				
Income	5.99	1.00	11.00	2.12
Satisfaction with:				
Autonomy on the job	15.48	4.00	20.00	3.33
Personal fulfillment from work	11.28	3.00	15.00	2.44
Financial characteristics of the job	14.06	4.00	20.00	3.08

$n = 2515$

Note. In addition to the variables shown, the study also included measures of demographic, socioeconomic, and academic ability characteristics (age, graduation cohort, race, sex, parental education level, family income, whether alumni lived in the Appalachian Region at high school graduation, educational aspirations, and ACT composite score), as well as marital status of alumni (hereafter referred to as basic controls). Descriptive statistics of additional variables are available upon request.

where:

- *Income* is a single item based on alumni year 2001 incomes, on an 11-point scale ranging from $0 to greater-than-or-equal-to $125,000.We did not find evidence of heteroskedasticity with this variable and therefore did not transform it to its natural log of dollars (Greene, 2000).
- *Job satisfaction* is comprised of three scales consistent with both the idea that employees' perceptions of job satisfaction represent a range of emotional states along multiple dimensions (Chartrand & Walsh, 1999; Hodson, 2002; Locke,

1976; Mirvis & Lawler, 1984), and past empirical research based upon extrinsic and intrinsic sources of job satisfaction (for example, see Gomez-Mejia & Balkin, 1984; Gruenberg, 1980; Smart et al., 1986). Based on direct measures of alumni satisfaction with their current job across a variety of work characteristics, the following scales were factorially derived from items ranging from 1 (''very dissatisfied'') to 5 (''very satisfied''): satisfaction with job autonomy ($\alpha = .88$), satisfaction with the level of personal fulfillment derived from the job ($\alpha = .80$), and satisfaction with the financial characteristics of the job ($\alpha = .73$). Table 2 presents information on specific item factor loadings and α reliabilities for each of the scales.

- *Major* represents a block of eight dummy variables. Based on alumni responses to a list of 23 major and occupational categories, we created the following major fields: Arts and Humanities ($n = 302$); Biological and Physical Sciences ($n = 176$); Business Related Fields ($n = 603$); Education ($n = 453$); Health Sciences and Related Fields ($n = 277$); Mathematics, Computer Science, and Engineering ($n = 126$); Social Sciences ($n = 352$); Technical and Applied Fields ($n = 226$). In all analyses, Education majors were the comparison group.
- *Congruence* consists of two measures relating majors to job fields. Our first measure identifies alumni perceptions with the question ''How closely related is your current job to the major in which you received your most recent degree/certificate?'' coded on a four-point scale (from 1 = ''not at all related,'' to 4 = ''highly related''). Our second measure was created as an objective, or actual, measure of congruence. In reporting their majors and occupations, alumni selected one of 23 general major or occupational categories, each of which we assigned to one of Holland's six primary types (RIASEC). We then applied Holland's hexagonal model (1985, 1997) to arrive at individual congruence scores.

Table 2
Rotated factor loadings and α reliabilities of job satisfaction scales

Scale/item	I	II	III	α
Satisfaction with job autonomy (I)				.88
Satisfaction with autonomy and independence	.50	.32	.30	
Satisfaction with opportunities to participate in Decision-making	.67	.35	.33	
Satisfaction with opportunities to exercise initiative	.90	.28	.23	
Satisfaction with opportunities to be creative	.64	.51	.11	
Satisfaction with personal fulfillment from job (II)				.80
Satisfaction with intellectual challenge	.40	.60	.26	
Satisfaction with feeling of accomplishment	.44	.69	.22	
Satisfaction with social status or recognition	.33	.49	.44	
Satisfaction with financial characteristics of job (III)				.73
Satisfaction with salary	.14	.18	.64	
Satisfaction with fringe benefits	.12	.01	.67	
Satisfaction with support for continuing education or service training	.18	.21	.51	
Satisfaction with opportunities for advancement	.33	.41	.51	

Note. All items coded 5 = very satisfied, 4 = satisfied, 3 = neither satisfied nor dissatisfied, 2 = dissatisfied, 1 = very dissatisfied.

Each of the 23 general major and occupational categories in the Alumni Survey accompanied a sub-group of fields intended as examples that respondents could use to gain a clear sense of the category that best described their major or occupation. However, because these examples did not always neatly fit within a singe Holland type, we selected 3 experts in the fields of educational assessment and higher education and asked them to assign primary Holland types to each major and occupational field presented in the Alumni Survey. Primary Holland types were then assigned to general major/occupational categories based on the majority opinion, or, the category that at least two of the three experts agreed upon. In every case at least two of the three experts agreed on the Holland type that best fit the major/occupational category.

Finally, we applied Holland's hexagonal RIASEC model to arrive at congruence scores. An actual congruence of 1 (''Not at all related'') was assigned to alumni whose majors and occupations were opposite one another on the hexagon, while a score of 4 (''Highly related'') was assigned to alumni with majors and occupations in the same Holland type. A score of 5 (''Exactly related'') was assigned to alumni who reported an exact match between major and occupation listed on the Alumni Survey, independent of the Holland type it had been assigned.

Our approach to constructing ''actual'' congruence was a slight variation on the ''first-letter agreement based on the hexagon'' (p. 213) that Young, Tokar, and Subich (1998) found to be positively correlated with other methods used for constructing congruence in relation to job satisfaction. With a .65 zero-order correlation with alumni perceptions of congruence and considerable agreement between ''expert'' opinions, the ''actual'' congruence variable appears to be a valid construct. For additional information on the numerous studies that have employed a first-letter agreement approach to measuring congruence, see Spokane (1985) and Spokane et al. (2000).

- a and z are two vectors, included to statistically control for potentially confounding differences within our sample of alumni. To fully explain outcomes of a college education, it is necessary to statistically control for differences in individuals' demographic and pre-college characteristics, as well as college experiences and characteristics of the institution attended (Astin, 1993; Pascarella & Terenzini, 1991). Smart (1989) has illustrated that many of these same characteristics are important in explaining the Holland vocational types of college graduates within a hexagonal framework. In addition, research on work organizations commonly considers characteristics of individuals' work experiences important to understanding job satisfaction, while Chartrand and Walsh (1999) have identified these as potentially confounding to research on congruence. We incorporated these lessons by including a, a vector of demographic and socioeconomic background characteristics, educational aspirations, academic ability, and marital status (hereafter referred to as ''basic controls''), and z, a vector of college and work experience characteristics. Specifically, z includes measures of type of higher education institution attended, college grades, and employment experiences including full-time employment, employment at a

for-profit organization or business, and whether or not the alumni worked in the Appalachian Region.

2.3. Analysis

Applying multiple linear regression techniques to Eqs. (1) and (2) we regressed the dependent variables on blocks of predictor variables, with the basic controls included in each model. Blocks of majors and congruence variables were entered in to each model sequentially to isolate the variance explained and to test our hypotheses of causality. For completeness, a "full" model was estimated to statistically control for potentially confounding influences of college and employment experiences on income and job satisfaction. The results generated in the full model should be interpreted as lower-bound estimates of majors and congruence variables, holding constant these additional and potentially confounding factors.

Linear regression enabled us to decompose estimated parameters into direct, indirect, and total effects. Because income was hypothesized to be a mediator of the effects of majors and congruence on job satisfaction, we isolated the direct, indirect, and total effects of major and congruence variables on the three dimensions of job satisfaction, net of the basic controls. Indirect effects were obtained by multiplying standardized coefficient estimates of major and congruence variables on income, by the standardized coefficient estimates of income on each dimension of job satisfaction (Alwin & Hauser, 1975; McClendon, 1994; Pascarella & Terenzini, 1991). In addition, we entered both congruence variables as a block and performed a partial *F* test to determine if these variables together significantly increased the variance explained of the dependent variables (Neter, Kutner, Nachtsheim, & Wasserman, 1996). To test the hypothesis that a causal order relates actual and perceived congruence, we estimated direct, indirect, and total effects of actual congruence, with perceived congruence acting as a mediator. In each case where we estimated indirect effects, Preacher and Leonardelli's (2003) Sobel Test Application was used to identify statistical significance.

3. Results

The results we report are weighted sample estimates, adjusted to the actual sample size to obtain correct standard errors. Because of the large sample size (2515) only estimates that were significant at the .01 level are identified. In addition, the estimated effects we report are standardized coefficients, representing the standard deviation (*SD*) change in a dependent variable associated with a 1 *SD* change of the independent variable, holding constant all other variables in the model.

Tables 3 and 4 present specific direct, indirect, and total effects of majors and congruence variables on job satisfaction. The standardized coefficient estimates of the predictors most relevant to our hypotheses are presented in Appendix A. Estimates of all predictors in each model are available upon request.

Table 3
Direct effects (DE), indirect effects (IE), and total effects (TE) of majors and congruence on job satisfaction[a]

	Income	Satisfaction with autonomy			Satisfaction with personal fulfillment			Satisfaction with financial characteristics		
	DE	DE	IE[b]	TE	DE	IE[b]	TE	DE	IE[b]	TE
Income		.231*		.231*	.257*		.257*	.462*		.462*
Degree major (Education = 0)										
Arts and Humanities	−.022	.071*	−.005	.066*	.057	−.006	.051	.080*	−.010	.069*
Business	.234*	.026	.054*	.080*	−.008	.060*	.052	.103*	.108*	.211*
Health Sciences	.156*	−.039	.036*	−.003	−.045	.040*	−.005	−.007	.072*	.065*
Math/Computer Science/Engineering	.150*	−.026	.035*	.009	−.029	.039*	.010	.032	.069*	.101*
Science	.033	−.034	.008	−.027	−.058	.008	−.049	−.018	.015	−.003
Social Sciences	.047	.007	.011	.018	−.040	.012	−.028	.036	.022	.058
Technical	.062*	.002	.014*	.016	−.022	.016*	−.006	.068*	.029*	.097*
Congruence										
Actual	.004	−.047	.001	−.046	−.078*	.001	−.077*	−.080*	.002	−.078*
Perceived	.076*	.108*	.018*	.126*	.193*	.020*	.212*	.034	.035*	.068*
$n = 2515$										

[a] Net of basic controls.
[b] Significance assigned using Preacher and Leonardellis' (2003) Sobel Test Application.
* $p < .01$.

Table 4
Direct, indirect, and total effects of actual and perceived congruence

	DE	IE[b]	TE
Satisfaction with autonomy[a]			
Actual	−.047	.067*	.020
Perceived	.108*		.108*
Satisfaction with personal fulfillment[a]			
Actual	−.078*	.120*	.042
Perceived	.193*		.193*
Satisfaction with financial characteristics[a]			
Actual	−.080*	.021	−.059*
Perceived	.034		.034

[a] Net of basic controls, majors, and income.
[b] Significance assigned using Preacher and Leonardelli's (2003) Sobel Test Application.
* $p < .01$.

Table 3 contains estimated direct, indirect, and total effects of degree majors and congruence on three dimensions of job satisfaction, net of the basic controls and income. We hypothesized that the effects of majors and congruence on job satisfaction would be mediated by income, resulting in indirect effects. As such, Table 3 contains the direct effects of each major (versus an Education major) and congruence variables on income and measures of job satisfaction, as well as the direct effects of income on the measures of job satisfaction. From these results four main findings appeared.

First, we found strong evidence that income mediates the effect of majors and congruence on job satisfaction. The size of the effect of income in predicting each dimension of job satisfaction was substantially greater than the effects of majors or congruence variables, with a 1 *SD* increase in income resulting in roughly a 1/5–1/2 *SD* increase in job satisfaction. Accordingly, the degree to which income mediated the relationship between major or congruence on job satisfaction depended on the direct effect that these variables had in predicting income. In each instance where there was a significant positive direct effect on income there was also a significant positive indirect effect on job satisfaction, mediated by income. Across each of the dimensions of job satisfaction, alumni who majored in a relatively high-income field (Business, Health Sciences, and Math/Computer Science/Engineering) or perceived their job to be related to their major had significantly greater job satisfaction indirectly, by way of income. Furthermore, our full model estimates indicate that the direct effects of income on job satisfaction become even more pronounced when college and work experience characteristics are held constant.

Second, net of the basic controls and holding constant income and congruence variables, an Arts and Humanities major had a significant and positive direct effect on satisfaction with autonomy and financial characteristics, and was the only field of study to have a significant direct effect on any dimension of job satisfaction without also accompanying a significant direct effect on income. Alternatively, Business and Technical/Applied majors each had a significant positive direct effect on satisfaction

with financial characteristics that accompanied a significant positive direct effect on income. While the majors that had the greatest effect on income were consistent with our expectations for quantitatively oriented subjects, it appears that holding income constant, the factors that led Arts and Humanities majors to report greater satisfaction with the autonomy as well as the financial characteristics of their jobs may be entirely different factors than employers reward with greater pay. In addition, once we controlled for differences in college and work characteristics, the effects of majoring in Arts and Humanities subjects became more pronounced in predicting each of the three dimensions of job satisfaction.

Third, actual and perceived congruence appear to have a more complex relationship with job satisfaction than expected. Holding constant the basic controls, major, income, and perceptions of congruence, actual congruence had either no effect or a significant negative effect on job satisfaction, depending on the dimension estimated. Net of the same factors but holding actual congruence constant, perceived congruence had a significant positive effect on the more intrinsic dimensions of job satisfaction (autonomy and personal fulfillment), and no effect on satisfaction with financial characteristics. Of the two congruence variables, only perceived congruence had a significant positive direct effect on income, which led to positive significant indirect effects and total effects on all three dimensions of job satisfaction.

With a zero-order correlation of .65, it is possible that multicollinearity biased our estimates when both measures of congruence were in a given model, making the unique effects of actual and perceived congruence difficult to interpret (though checks of standard errors and R^2 suggested multicollinearity did not bias our results). Even in the presence of multicollinearity, however, it is possible to assess the variance explained when both measures of congruence simultaneously predict income or job satisfaction. For each of the models predicting income or job satisfaction, the variance explained significantly increased upon entering the congruence variables (see Appendix A, column II). While statistically significant, the combined effects of perceived and actual congruence differed by dimension of satisfaction, with the greatest variance explained for satisfaction with personal fulfillment (.022). This result is evidence that congruence, in general, has a substantive role in predicting income (net of the basic controls and major) as well as job satisfaction (net of the basic controls, major, and income).

Fourth, for a more precise analysis of the relationship between each measure of congruence and job satisfaction, Table 4 presents standardized estimated direct, indirect, and total effects, net of the basic controls, majors, and income. These results lend partial support to our expectation that perceptions of congruence mediate the effects of actual congruence on job satisfaction. For both intrinsic dimensions of job satisfaction (autonomy and personal fulfillment), we found perceptions of congruence to have a significant positive direct effect and actual congruence to have a significant positive indirect effect, mediated by those preferences. Alternatively, we found a significant negative effect of actual congruence on satisfaction with financial characteristics that was not significantly mediated by perceived congruence.

Comprised of both the direct and indirect effects, the total effect of actual congruence in predicting satisfaction with autonomy or personal fulfillment were not statistically significant. Total effects represent the effects of actual congruence when perceptions of congruence are not held constant. If we had predicted job satisfaction using actual congruence alone, our only statistically significant finding would have been a negative effect on satisfaction with financial characteristics. No effect would have been found in predicting satisfaction with autonomy or personal fulfillment, and we would not have observed the mediating role that perceived congruence had in predicting the intrinsic dimensions of job satisfaction.

Interestingly, our results support the expectation of a positive relationship between congruence and job satisfaction only when congruence was measured by alumni perceptions, satisfaction based on intrinsic factors, and actual congruence held constant. Our expectations were not supported when only actual congruence was included in our models (i.e., total effects). Because job satisfaction and perceptions of congruence are both self-reflective interpretations of one's experiences, it is reasonable that the more alumni felt their job related to their major, the more they reported greater intrinsic satisfaction with their jobs. In terms of our objective measure of congruence, however, this did not hold.

While not hypothesized, to thoroughly disentangle the relationships between actual congruence, perceived congruence, and job satisfaction, we additionally estimated direct effects of perceived congruence on the three dimensions of job satisfaction, net of the basic controls, majors, and income. For each job satisfaction variable, when actual congruence was allowed to vary, the estimated effects of perceived congruence were less than the effects found when actual congruence was held constant. However, in all three cases, neither the statistical significance nor the direction of significant relationships differed based on actual congruence being held constant. Ultimately, it appears that among our sample of alumni, there is a more consistent positive relationship between congruence and job satisfaction for perceptions than for actual levels of congruence, whether or not actual congruence is held constant.

4. Discussion

The process by which an individual's choice of college major may translate into a better, more personally rewarding job is a sequential series of events confounded by a vast number of personal and work-related experiences. The approach we have taken in this study attempts to isolate the effects of different college majors on the satisfaction derived from the work experiences of alumni 5–25 years after college. Our results support the overall causal model illustrated in Fig. 1, where income and congruence both significantly mediate the effects of college major on job satisfaction.

The relationships between majors and income were consistent with our expectations and confirm past studies that have identified a positive earnings effect of major-

ing in quantitative and scientifically oriented subjects. Independent of individual differences in income, as well as demographic, socioeconomic, and ability background characteristics, there appears an interesting set of relationships between majors and job satisfaction. Majoring in Arts and Humanities subjects may lead to significantly greater levels of satisfaction with autonomy than other majors (including higher-earnings fields), as well as greater levels of satisfaction with personal fulfillment if the differences in college and work experience characteristics are held constant. All else equal, majoring in the Arts and Humanities may hinder college graduates' abilities to earn greater income than their peers who entered more financially lucrative fields, but it may also advantage them in achieving a more intrinsically satisfying work experience.

In addition, it is difficult to overstate the role of income in influencing job satisfaction. In our direct effects models, income had an effect that was, on average, over four times greater than other statistically significant independent variables. Had we not included income in our models, such as Elton and Smart (1988) and Smart et al. (1986), we would not have identified several interesting relationships (see Table 3, Total effects). For example, we would have underestimated the effects of majoring in Arts and Humanities on satisfaction with autonomy and financial characteristics by roughly 7 and 14%, respectively. In terms of higher-earning majors, we would not know that it is entirely because of the effect of income on job satisfaction that majoring in Business affected satisfaction with autonomy, or that majoring in Health Sciences or Math/Computer Science/Engineering affected satisfaction with financial characteristics. Finally, we would have over-estimated the effects of perceived congruence on all three dimensions of job satisfaction. To fully understand the role of college major and congruence on job satisfaction, it is essential to control for individual differences in work-related incomes.

Furthermore, the relationship between congruence and job satisfaction appears to vary by dimension of satisfaction and the manner by which congruence is measured. Our results show that the effects of congruence depend on whether or not actual and/or perceived measures are specified, as well as the dimension of job satisfaction predicted. For example, in predicting satisfaction with personal fulfillment, we found actual congruence to have a significant negative effect, holding perceived congruence constant, but no significant effect when perceived congruence was allowed to vary. Our results support those of Spokane (1979) and Spokane and Derby (1979) by identifying actual congruence as a significant and positive predictor of perceived congruence, and indicate that perceived congruence mediates the effect of actual congruence on intrinsic dimensions of job satisfaction.

While past research suggests that congruence is a positive influence on vocational outcomes such as job satisfaction (Spokane, 1985; Spokane, Meir, & Catalano, 2000), our results should be a warning against treating congruence as a general concept. Measures of actual and perceived congruence, though highly correlated, are never perfectly related (Caplan, 1987). In the presence of such imperfections, the burden falls on the researcher to assess how different measures of congruence impact the

vocational outcomes being studied. At the very least, the differences we found between distinct measures of congruence and dimensions of job satisfaction should be considered when interpreting other research that may include actual congruence, perceived congruence, or both.

The longitudinal nature of our data allowed us to statistically control for a wide range of differences in individual background, college, and work experience characteristics in estimating the unique impact of college majors and major–job field congruence on job satisfaction. This study, however, had several limitations. Although the sample contained alumni from 30 colleges and universities that varied by organization, size, and mission, one should take caution before generalizing our findings to other alumni from other institutions. Our weighting procedure corrected for some bias by sex, graduation cohort, and institution, but could not adjust for the non-response bias that may have resulted from difference between those alumni who were invited to participate in the study but did not, and those who ultimately participated. Finally, it is important to recognize the limitations inherent in our methods. Discussing causal modeling of college outcomes, Pascarella and Terenzini (1991) explained that when empirical results "support the presence of a hypothesized causal relationship, this suggests only the *possibility* that the observed relationship may be causal. One does not confirm a causal relationship with regression coefficients in causal modeling; one only 'fails to disconfirm it'" (p. 676).

Following their review of research on congruence, Spokane et al. (2000) identified the importance of longitudinal, causal approaches to studying the effects of congruence on vocational outcomes and called for increased attention to the possibility that mediating factors exist. Only then, Spokane et al. argue, will we approach a theory that is most valuable for career and vocational counseling. Having assessed the unique and combined effects of two different measures of congruence on three distinct dimensions of job satisfaction, we have extended our understanding of these complex relationships and focussed on the powerful evidence that income has an important mediating role in determining job satisfaction. Income does indeed explain much of the variation in job satisfaction, but it does not explain everything. Job satisfaction appears also to be enhanced by majoring in Arts and Humanities subjects, as well as individuals' perceptions congruence, irrespective of work-related income, actual congruence, or other characteristics of the work experience. Such knowledge may prove useful in the career decision-making of college students in their quest for better, more satisfying professional lives while also providing support for future research using congruence to study vocational outcomes of the college experience.

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Appendix A

Standardized coefficient estimates of variables predicting income and job satisfaction[a]

Predictive variables	Income			Dimension of job satisfaction								
				Autonomy			Personal fulfillment			Financial characteristics		
	I	II	III	I	II	III	I	II	III	I	II	III
Income				.239*	.231*	.267*	.271*	.257*	.307*	.461*	.462*	.491*
Degree major (Education = 0)												
Arts and Humanities	−.037	−.022	−.041	.064*	.071*	.081*	.043	.057	.066*	.095*	.080*	.081*
Business	.235*	.234*	.150*	.030	.026	.031	−.002	−.008	.014	.110*	.103*	.102*
Health sciences	.164*	.156*	.150*	−.032	−.039	−.044	−.032	−.045	−.043	−.009	−.007	−.016
Math/Computer Science/ Engineering	.154*	.150*	.095*	−.018	−.026	−.028	−.015	−.029	−.017	.039	.032	.030
Science	.023	.033	.052*	−.034	−.034	−.035	−.059*	−.058	−.061	.001	−.018	−.025
Social Sciences	.031	.047	.037	−.005	.007	.007	−.063	−.040	−.036	.045	.036	.031
Technical	.060*	.062*	.020	.005	.002	−.002	−.017	−.022	−.020	.079*	.068*	.064*

Congruence												
Actual		.004	.022		−.047	−.047		−.078*	−.086*		−.080*	−.080*
Perceived		.076*	.117*		.108*	.101*		.193*	.174*		.034	.034
College measures												
Private college[b]			.044			−.082*			−.109*			−.055
Public university[b]			.089*			−.031			−.094*			−.050
Selectivity			.018			.064*			−.017			.024
Grades			.032			.058*			.048			-.003
Work characteristics												
Full-time			.289*			−.077*			−.073*			−.074*
For-profit organization			.186*			−.008			−.059*			−.001
Work in Appalachia			−.149*			.032			.028			-.020
R^2	.308	.314	.444	.065	.071	.085	.078	.100	.113	.195	.199	.206
Change in R^2		.006*	.130*		.006*	.014*		.022*	.013*		.004*	.007*
$n = 2515$												

[a] All estimates are net of basic controls.
[b] Dummy variable compared against Work college alumni.
* $p < .01$.

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