ESTUDIOS

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Testing Social Cognitive Career Theory in Colombian adolescent secondary students: a study in the field of mathematics and science

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Abstract. This study aims to validate the model for vocational interests and choices defined by Social Cognitive Career Theory (SCCT) in the context of Colombian secondary education, with a view to extending previous research in various ways. Firstly, in terms of cross-cultural validation, it examines the whole core of the model of vocational interests and choices in the science/mathematics area for the first time with Latin-American secondary school students. Secondly, it tests the SCCT model for the first time in an ethnically diverse population outside the United States, including minority groups. Finally, it examines the role in this new context of the perceived social support in career development processes. 2,787 Colombian secondary school students took part in the study. The subjects were evaluated for self-efficacy, outcome expectations, interests, occupational aspirations and perceived social support for entry to careers in the science/mathematics area. Structural equation modeling (including multi-group analysis for gender and ethnic group) was used to test the fit of the hypothesized model to the data. In the full sample, results indicated global support for SCCT as a way to predict Colombian students' interests and occupational aspirations in the field of mathematics and science (CFI=.96 and RMSEA=.046). All the hypotheses formulated were verified with the exception of those related to the direct effects of self-efficacy and outcome expectations in connection with occupational aspirations. Collectively, the predictors accounted for 52% of the variance in interests and for 40% of the variance in occupational aspirations. In addition, results also suggest that the model is invariant across gender and ethnic groups (White Colombian, Mestizo Colombian and Afro-Colombian). The implications for *both future research* on SCCT and intervention are discussed.
Keywords: Career development; occupational aspiration; vocational interests; STEM education; Latin Americans.

[es] Evaluación de la teoría cognitivo social del desarrollo de la carrera con estudiantes adolescentes colombianos de educación secundaria: un estudio en el área científico-matemática

Resumen. El objetivo del estudio es validar el modelo de intereses y elecciones vocacionales definido por la Teoría Cognitivo Social del Desarrollo de la Carrera (SCCT por sus siglas en inglés) en el contexto de la educación secundaria colombiana. Con ello se pretende contribuir a la investigación previa en varios sentidos. Primero, en términos de validación trascultural, se examina por primera vez el núcleo completo del modelo en el área científico-matemática con alumnado de educación

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secundaria latinoamericano. En segundo lugar, se estudia por primera vez el modelo cognitivo social en población no estadounidense étnicamente diversa, incluyendo grupos minoritarios. Finalmente, se analiza en este nuevo contexto el papel del apoyo social percibido en los procesos de desarrollo de la carrera. Los participantes fueron 2787 estudiantes colombianos de educación secundaria. Los sujetos completaron medidas de autoeficacia, expectativas de resultado, intereses, aspiraciones ocupacionales y apoyo social percibido para ingresar en carreras del área científico-matemática. Se usaron Modelos de Ecuaciones Estructurales para evaluar el ajuste del modelo hipotetizado a los datos, incluyendo análisis multigrupo para las submuestras definidas por género y por grupo étnico. En la muestra completa los resultados prestaron apoyo al modelo cognitivo social como marco para predecir los intereses y las aspiraciones ocupacionales de los estudiantes colombianos en el área científico-matemática (CFI=.96; RMSEA=.046). Todas las hipótesis formuladas fueron verificadas con excepción de las referidas a los efectos directos de la autoeficacia y de las expectativas de resultado sobre las aspiraciones ocupacionales. En conjunto, los predictores explicaron el 52% de la varianza de los intereses y el 40% de la varianza de las aspiraciones ocupacionales. Además, los resultados sugirieron que el modelo es invariante en razón del género y del grupo étnico de pertenencia (blanco, mestizo o afro-colombiano). El trabajo discute las implicaciones de estos resultados para la investigación futura y para la intervención en el ámbito del desarrollo vocacional.
Palabras clave: Desarrollo vocacional; aspiraciones vocacionales; intereses vocacionales; educación en Ciencia; Tecnología; Ingeniería y Matemáticas; Latinoamericanos.

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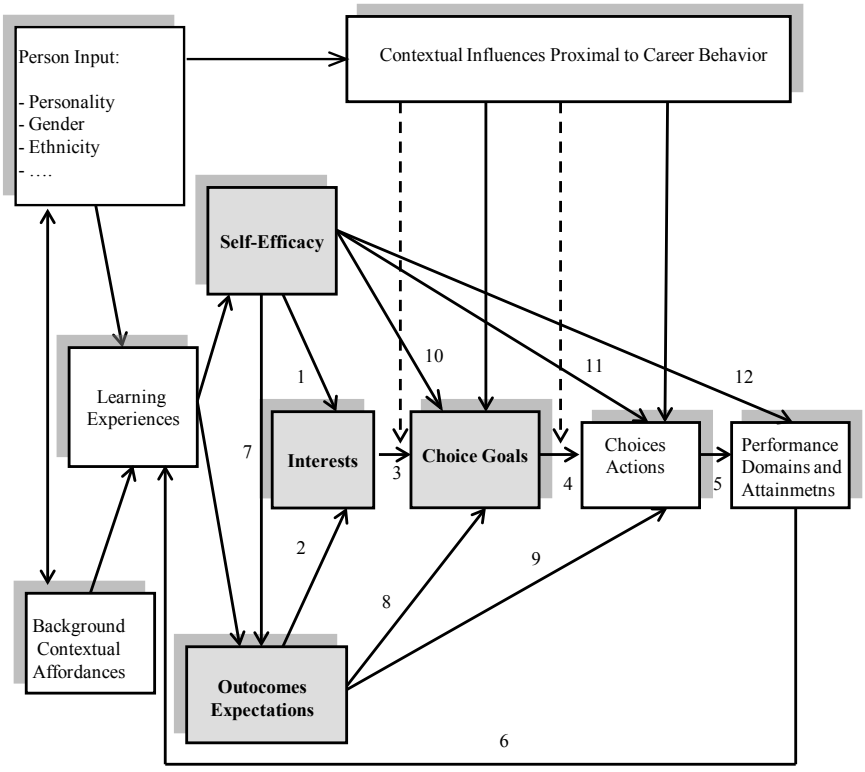
1. Introduction

In accordance with social cognitive theory, individuals tend to select or avoid certain activities in response to cognitive mechanisms for evaluating skills, so that the expectations of efficacy they have for themselves (self-efficacy) occupy a central position in the functioning of the self system (Bandura, 1986, 1997). From this perspective, the answer to the question "Can I really do this?" has a strong impact on an individual's involvement/avoidance behavior in a given sphere of activity. This seminal idea is developed specifically in Social Cognitive Career Theory (SCCT; Lent, Brown & Hackett, 1994, 2000), providing a heuristic model to explain vocational development. In an effort to explain interests development, academic and career choice options and performance, SCCT expands on the constructs introduced in Bandura's theory in three different but related models: interest, choice and performance (Lent, Brown, & Hackett, 1994).

The choice SCCT model is built on a core which specifies the causal relationships between the basic social cognitive constructs: self-efficacy, outcome expectations, interests, and academic and professional goals. The other dimensions intervening in the processes of career development are organized around this central segment (see Figure 1).

Figure 1. The Social Cognitive Career Theory: Choice Model
(Lent, Brown and Hackett, 1994)



SCCT maintains that subjects develop interest in an activity when they see themselves as competent to carry it out (positive expectations of self-efficacy) and when they anticipate that their involvement in it will lead to results considered valuable (positive outcome expectations), as shown in links 1 and 2 in Figure 1. In a complementary sense, emerging interests (together with self-efficacy and outcome expectations) lead to the establishment of goals or the intention to be involved in activities (link 3). Such goals or intentions, for their part, increase the likelihood of effective involvement in the activity (link 4), from which certain results or achievements will be derived (link 5). Finally, achievements related to performance (in the form of scores, self-satisfaction, etc.) provide essential information for the consolidation or review of self-efficacy and outcomes expectations (link 6).

The model also establishes that self-efficacy partly determines outcome expectations, since when a subject's assessment of his or her ability to carry out an activity successfully is positive, he or she is also likely to expect positive results derived from it (link 7). It is also hypothesized that subjects establish goals and choose activities according to both their interests and the results anticipated (links 8 and 9). Perceptions of self-efficacy also have a direct effect on the goals (link 10), choice (link 11) and performance of activities (link 12).

Finally, Figure 1 also gives an overall view of how the basic social cognitive mechanisms defined in the model are affected by personal (e.g. gender) and contextual (e.g. socio-economic conditions) factors which also contribute to academic and professional outcomes.

Lent, Brown & Hackett's (1994) social cognitive career theory has motivated substantial empirical research into vocational and academic predictors of interests and choice goals and performance. Taken as a whole, the meta-analytic reviews carried out of SCCT research in the United States (Brown et al., 2008; Sheu et al., 2010) have proven that theory to be helpful in understanding a variety of generic interest domains, such as Holland's six RIASEC interest themes. The reviews have also stated that SCCT has been successfully applied to several more specific interest/choice academic domains, with a preponderance of the math/science field, and has been used satisfactorily in studies on university major choices, with a main focus on the technological/engineering area. As a result, SCCT has become one of the principal frame works for explaining the processes of recruitment and persistence in STEM (Science, Technology, Engineering and Mathematics) careers (Wang, 2013).

Although most research into SCCT has been carried out with university students in the United States (Blanco, 2009), there are a substantial number of studies designed to validate social cognitive hypotheses, especially those referring to the model for the development of interests and the choice of vocational goals, in other cultural contexts and with younger, secondary school, students. In Europe this is the case of the studies by Lent, Brown, Nota et al., (2003) with Italian students; by Lent, Da Silva, Paixão & Leitão (2010) with Portuguese students; by Katsikis & Sygkollitou (2013) with Greek students; and by Rodríguez, Inda & Fernández (2015) with Spanish students. Overall the results have supported the cross-cultural validity of SCCT in the European context when used to explain the academic and professional interests and goals of secondary students.

SCCT has also received attention in Latin America, although research has focused mainly on the academic performance model. This section of SCCT has been validated with satisfactory results with secondary students in Argentina (Cupani, Richaud, Pérez & Pautassi, 2010; Cupani & Pautassi, 2013; Zalazar, Cupani & De Mier, 2015). Although there are some studies that partly analyze the socio-cognitive hypotheses involved in the model for vocational interests and goals (Cupani & Pérez, 2006), in Latin America there has been no evaluation taking its core variables into account (self-efficacy, outcome expectations, interests, goals/intentions). The relevance of SCCT in explaining the vocational processes of Latin American students is thus an area of research which is largely pending. In Colombia, as there are no previous studies of SCCT, the contributions that this framework could make to understanding the education and academic-professional orientation of Colombian students have not been explored.

In this context, the aim of the present study was to test SCCT in Colombian secondary education. Specifically, this research examined the usefulness of the core of the SCCT interest and choice models in predicting mathematical/scientific interests and occupational aspirations among Colombian secondary students (links 1, 2, 3, 7, 8 and 10 in Figure 1).

The reason for selecting the mathematical/scientific area is that Latin America is one of the areas with the lowest proportions of students in scientific and technological careers (OCDE/CEPAL/CAF, 2015; Peralta, Caspary & Boothe, 2013). For the

region it is an important challenge to implement education programs in the STEM field which make it possible to improve the quality of life of its inhabitants, create jobs and increase the region's competitive position in the world (Geromini, Bergero, Di Blasi, Pelem, Carvajal & Bosch, 2011). In this scenario it is relevant to evaluate whether, in a way similar to that found in other cultural contexts, SCCT constitutes a useful framework for explaining the vocational trajectories of Colombian students in scientific and mathematical careers.

The research focused on testing four principal hypotheses:

Hypothesis 1. Self-efficacy and outcome expectations predict jointly interests in math/science.
Hypothesis 2. Math/science self-efficacy contributes to outcome expectations, and also affects interests indirectly through outcome expectations.
Hypothesis 3. Interests in math/science are predictive of occupational considerations in this field.
Hypothesis 4. Self-efficacy and outcome expectations affect occupational aspirations in the math/science field both indirectly (through interests) and directly.

Since these four hypotheses concerning the SCCT core have received the strongest empirical support to date (particularly those referring to direct effects), they were considered the principal predictions in this study, the first in the Colombian context. In addition, the study examined the role of perceived social support in the development of math/science interests and occupational aspirations (Lent, Brown & Hackett, 2000).

An abbreviated 5-variable model was tested in the present study (see figure 2). We did not include perceived social barriers (a variable frequently included in research into SCCT) because support for paths from this variable to occupational aspirations and self-efficacy has been inconsistent in prior studies with Italian (Lent, Brown, Nota et al., 2003) and Portuguese secondary students (Lent, Da Silva, Paixão & Leitão, 2010), and also with U.S. low-income secondary students (Garriot, Flores & Martens, 2013). In addition, the magnitude of the relationship between barriers and self-efficacy in previous studies has been consistently smaller compared to that of support and self-efficacy (Lent et al., 2008; Lent, Sheu, Gloster & Wilkings, 2010; Rodríguez, Inda & Fernández, 2015), suggesting supports may be of relatively greater importance than the perception of barriers in the SCCT model (Garriot, Flores & Martens, 2013). Other studies with secondary students in the area of science and mathematics also limited the contextual influences to the dimension of perceived social support (Navarro, Flores & Worthington, 2007). As SCCT was to be evaluated with Colombian students for the first time, a simple model was defined including relations with greater prior empirical support. Following the work of Sheu et al. (2010), the following additional hypothesis was tested:

Hypothesis 5. Perceived social support predicts math/science self-efficacy, outcome expectations, and occupational aspirations in the math/science field.

An aspect of special importance regarding the STEM field is the well-documented under-representation of women (e.g. Vázquez & Manassero, 2015) and

ethnic minorities (Lent, Sheu, Gloster & Wilkins, 2010). Previous research into SCCT has also paid special attention to analyzing whether its hypotheses are independent of gender, i.e. whether the explanatory model is applicable to both male and female students (e.g. Navarro, Flores & Worthington, 2007; Rodríguez, Inda & Fernández, 2015). In addition, the agenda for research into SCCT has also focused on analyzing the hypotheses in different ethnic and minority groups, with a view to evaluating possible differential processes in career development (e.g. Byars-Winston et al., 2010; Lent et al., 2005). Application of SCCT´s basic interest and choice models to Hispanic, African American and Asian American student samples in the United States has found support for the cross-cultural relevance of these models (see Lent & Sheu, 2010, for a review). With a view to contributing new evidence in this sense, all hypotheses formulated in the present study were tested in male and female subsamples and across different ethnic groups of the population of Colombia.

Colombia is ethnically diverse, its people descending from the original native inhabitants, Spanish colonists, Africans originally brought to the country as slaves, and 20th-century immigrants from Europe and the Middle East (Aristizábal, 2000). According to the latest census by the National Administrative Department of Statistics (Departamento Administrativo Nacional de Estadística), (2007), the breakdown of population groups in Colombia is as follows: 49% mestizo, 37% white, 10.6% Afro-Colombian and 3.4% Amerindian. Differences in educational results have been reported between the different ethnic groups (Cerquera, 2014; Sánchez, 2011). Specifically, areas which are predominantly mestizo and white have better results in mathematics and science than areas with larger numbers of Afro-Colombians and Amerindians (National Ministry of Education in Colombia [Ministerio de Educación Nacional de Colombia] 2014). The minority Amerindian and Afro-Colombian groups, whose social and economic conditions have been historically less favorable, not only have inferior educational results but are also less likely to remain in the educational system (Rivera, 2015). It is thus of special importance to verify whether SCCT can be a useful framework for explaining the academic and professional development of Colombian students belonging to racial minorities.

In accordance with the foregoing, the following invariance hypotheses were tested:

*Hypothesis 6***.** The relations in the model do not vary according to the students' gender.

Hypothesis 7. The relations in the model do not vary according to the ethnic group students belong to.

In short, this study aims to contribute to the existing research into SCCT with various types of new evidence. Firstly, in terms of cross-cultural validation, it examines the whole core of the model of vocational interests and choices in the science/mathematics area for the first time with Latin-American secondary school students in Colombia. Secondly, it tests the SCCT model for the first time in an ethnically diverse population outside the United States, including minority groups. Finally, it examines the role in this new context of the perceived social support in career development processes.

2. Method

2.1. Participants

The participants in this study were 2,787 Colombian secondary students (53% female and 47% male). The age of the subjects ranged from 14 to 21 years, the average age of the sample being 15.4 years (SD=1.2). The sample was taken from grades 9 (26%), 10 (42%) and 11 (29%), although a residual number of students were in grades 12 and 13 (3%).As there are various educational options in Colombia after grade 10, the sample included a wide range of them. The students were enrolled in 9 different schools, 8 of them public and 1 private, in different cities in Colombia. 4 schools were in Bogotá (49% of the participants), 3 in Quibdó (40%), 1 in Medellín (7%) and 1 in La Dorada (5.0%).12% of the students' mothers and 13% of their fathers had a basic school diploma; 52% of mothers and 46% of fathers had a secondary school diploma; and 21% of mothers and 22% of fathers had a university diploma. 8% of mothers and 10% of fathers had not completed basic education. The "other" option was chosen or data one education were not available for 9% and 7% of fathers and mothers respectively. The breakdown by ethnic group was as follows: 39% Afro-Colombian, 36% mestizo, 23% white, and 0.8% Amerindian. Slightly under 2% selected the option "other". It is important to note that in the sample used for the study the Afro-Colombian group is over-represented, as for the purposes of the research it was particularly interesting to compare the results obtained for different ethnic groups and these needed to be sufficiently large to allow statistical processing.

2.2. Instruments

The instruments used in this study were adapted Colombian versions of instruments previously adapted and validated for Spanish secondary students by Blanco-Blanco, Casas & Mafokozy (2016). This Spanish study applied the following United States measures: *Mathematics and Science Self-Efficacy Scale* (MSSE; Fouad & Smith, 1997), *Math/Science Outcome Expectations* (Lent et al., 2003), *Math/Science Interest Scale* (MSIS; Smith & Fouad, 1999) and *Social Reactions scale* (Lent et al., 2003). In addition, a measurement for occupational objectives/considerations was designed and validated, consisting of an inventory of 10 briefly described professions or occupational qualifications. The occupational qualifications and the instructions were adapted from the scheme proposed by Gore (1996; Gore & Leuwerke, 2000). The occupational descriptions were taken from the O*NET program (www.onetonline.org). The results presented by Blanco-Blanco,Casas & Mafokozy (2016) suggest that all the scales are reliable and valid measures of the constructs. The reliability coefficients of the scales vary between .76 and .91. Factor analyses suggested that the solutions were aligned with the theoretical and conceptual structure of the scales. The scales also correlated with each other in a way consistent with the theory and previous research.

The adaptation process in the present study included the evaluation of all measurements by four Colombian experts (counselors and teachers). As a result of this review, in the Colombian version only a few items were slightly rephrased to adapt them to the Colombian context:

Math/Science self-efficacy. Self-efficacy was measured using 12 items that assess school students' confidence in their abilities to successfully perform mathematics and science-related tasks (e.g. "Earn an A in math", "Design and describe a scientific experiment you want to do"). Participants were asked to indicate on a 7- point rating scale, anchored by 1= no confidence at all, to 7= complete confidence, their confidence in their ability to accomplish each task. The alpha coefficient in the Spanish study was .86 and in the present study it was .84

Math/Science outcome expectations. A nine-item scale was used to assess outcome expectations. The items reflect a variety of positive outcomes that might accrue from going into an occupation that involves scientific or mathematical skills (e.g., "earn an attractive salary", "get respect from other people"). Subjects indicated their level of agreement with each statement on a 7-point scale ranging from strongly disagree (1) to strongly agree (7). Blanco-Blanco, Casas & Mafokozy (2016) found a reliability coefficient of .91 for this measurement. The scale had anα coefficient of .88 in this study.

Math/Science interests. Interests was measured by using a 16-item scale that assessed school students' interest in activities related to mathematics and science (e.g. "Solve math puzzles" and "Visit a science museum"). Participants indicated how interested they were in performing each of the 16 math/science related activities (1=Not at all interesting to 7= very interesting). The internal reliability coefficient for the present sample was .89, identical to that reported for the Spanish sample.

Math/Science-related occupational aspirations. To assess occupational choice aspirations students indicated how seriously they would consider each of 10 occupations "as a possible career for yourself" (1 = Not Very Seriously; 7 = Very Seriously). Sample occupational titles were "Biologist", "Astronomer" and "Physicist". All titles were accompanied by a brief description. For example, Biologist was described as follows: "a person who researches or studies basic principles of plant and animal life, such as origin, relationship, development, anatomy, and functions". The alpha coefficient of this 10-item occupational aspirations scale in the previous work with Spanish students was .88 and in this study it was .92.

Social support. Social support has been defined as perceived supportive influences from teachers, parents, and friends (see, among others, Garriot, Flores & Martens, 2013; Lent, Brown, Nota, & Soresi, 2003; Lent, Paixão, et al., 2010). In this study social support was measured via 4-items. Instructions indicated that "this part of the questionnaire asks about the types of reactions you might expect to receive from important people in your life, if you were to choose certain occupational paths. Imagine specifically that you wished to enter an occupation that involved scientific or mathematical skills (for example biologist, medical doctor, engineer)." They were then presented with the item stem, ''If I were to enter such a field, I would…" followed by the four support statements (e.g., "feel support for this decision from important people in my life"). They were asked to indicate their level of agreement or disagreement with each statement on a 7-point scale (1= Strongly Disagree; 7=Strongly Agree). In previous studies with Italian and Portuguese secondary students a reliability coefficient in the range .81-.88 was found (Lent, Brown, Nota & Soresi, 2003; Lent, at al., 2010). In the study by Garriot, Flores & Martens (2013) the reliability coefficient was .90. Although in

the prior study with Spanish students the α coefficient for social support was not reported (because Blanco, Casas & Mafokozy used a combined measurement of support and barriers), in the present study the α coefficient was acceptable for the 4-item social support scale (α=.75).

2.3. Procedure

The questionnaire was completed voluntarily and anonymously in an average of 35 minutes by students in the participating schools. Permission was previously requested from the management of the schools and the consent of the participating students' families was also obtained. All data collection sessions were supervised by the first author of this study, who explained the task briefly to the students and dealt with the occasional queries they had.

3. Results

3.1. Analysis of data

The total number of subjects taking the survey was 2830, but cases that had one or more scales on which a participant did not answer at least 75% of the questions were excluded (Parent, 2012). This method resulted in the exclusion of 43 participants. Analysis of missing data for the 2787 remaining participants indicated that 1,2 % of all items for all participants/cases were missing Given the small amount of missing data mean substitution was used to handle missing values. Additional analyses were carried out to identified univariate outliers (z-scores lower than 3.29) and multivariate outliers (as identified using the Mahalanobis distance procedure). No cases were eliminated as a result of this analysis. Finally, we assessed univariate and multivariate normality. Multivariate normal distribution of the variables in the models could not be assumed (Mardia's normalized coefficient estimated >5), which had to be taken into account in the subsequent analyses.

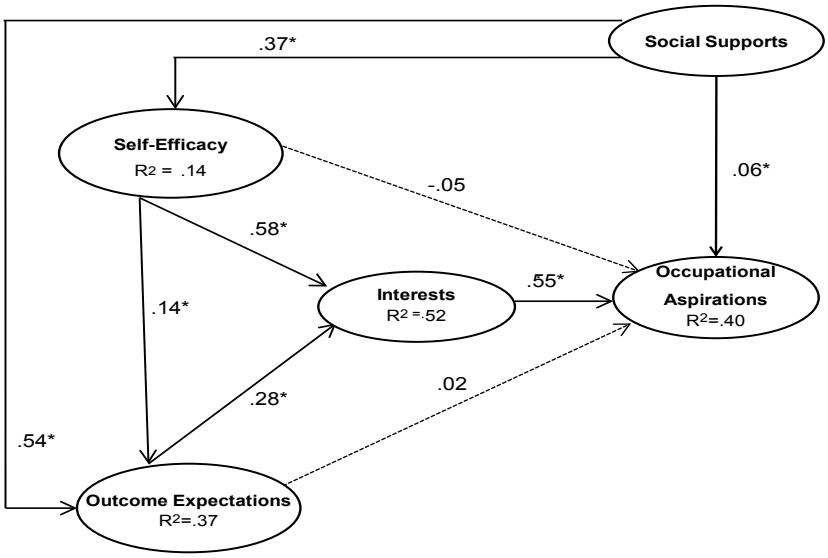
Structural equation modeling was performed using EQS 6.1. and the maximum likelihood (ML) estimation method. We modeled the measurement error in the observed variables representing each of the SCCT constructs by creating multiple observed indicators of each construct from the scale items. In the case of the perceived social support construct, the four original items formed the composite indicator. Item parcels were used to create multiple indicators for each of the other constructs (Bentler & Wu, 2005). Item parcels were created by taking the mean of a set of 3-4 items within a factor. Self-efficacy was indexed by four item parcels, with three items in each parcel. Outcome expectations were represented by three indicators containing 3 items. Interest was indexed by 4 parcels containing 4 items and, finally, three parcels with 3-4 items represented the occupational aspirations construct. This process produced a covariance matrix with 18 indicators as input data for each model test. The covariate matrices used in the analyses are available on request from the author.

*R*obust maximum likelihood estimation procedures were employed in all the analyses because of multivariate non-normal distribution of the variables (Bentler

& Wu, 2005). Therefore, we used the Satorra-Bentler scaled chi-square test (S-Bχ^2) to evaluate the statistical fit of models to data, which is corrected for non-normality. Because of the chi-square test's dependence on sample size two other robust practical fit indices based on scaled statistics were used: the comparative fit index (CFI) and the root mean square error approximation (RMSEA). CFI values ≥ .95 and RMSEA ≤ .05 indicate a very close model-to-data fit while CFI values ≥ .90 and RMSEA ≤ .08 represent an adequate model-to-data fit (Kline, 2005). The main *criterion* used to judge significant model differences was a change in *CFI* of greater than .010 between *nested models, because the chi-square difference test (which we also examined) has been found to be sensitive to sample size and model complexity (Cheung & Rensvold, 2002*)**.**

The hypothesized model was fitted via a two-step approach (Anderson & Gerbing, 1988; Kline, 2005). First, confirmatory factor analyses were conducted to determine whether the latent variables were adequately measured by the observed variables (one factor loading for each construct was fixed to 1). Then, path analyses were carried out to evaluate the structural model, which included only the relationships among variables in the hypothesized model (see figure 2).

Figure 2. Social Cognitive Career Choice model tested in this study



3.2. Full sample analyses

As shown in Table 1, a five-factor measurement model produced a good fit to the data.

Table 1. Fit indices for the measurement and structural models

Model	χ^2	S-Bχ^2	*Df*	ΔS-Bχ^2	Δ*df*	RMSEA[a]	CFI[a]	ΔCFI[a]
Full Sample								
Measurement model	1028.79	827.22*	125	-	-	.045	.97	-
Structural model	1100.02	884.98*	126	61.53*	1	.046	.96	.01
Random sample of 50% of subjects (n=1394)								
Structural model	746.18	609.67*	126	-	-	.052	.96	-
Multi-group analysis								
Grouping variable: gender								
Measurement model without constraints	1181.74	956.26*	250	-	-	.032	.97	-
Measurement model with constraints on all loadings	1197.96	976.32*	263	15.33	13	.031	.97	.00
Structural models without constraints	1267.72	1033.75*	265	-	-	.032	.96	-
Structural model with constraints on all structural paths	1290.74	1052.97*	274	19.02*	9	.032	.96	.00
Grouping variable: ethnicity								
Measurement model without constraints	1336.82	1081.21*	375	-	-	.026	.96	-
Measurement model with constraints on all loadings	1349.98	1097.41*	388	12.54	13	.026	.96	.00
Structural models without constraints	1413.41	1149.34*	391	-	-	.027	.96	-
Structural model with constraints on all structural paths	1433.24	1166.31*	400	16.69	9	.027	.96	.00

a Derived from robust maximum likelihood estimation.
*$p < .05$.

Although the chi-square test was significant (as expected, given the sample size), the CFI and RMSEA indices met the cut-off criteria (CFI ≥.95 and RMSEA ≤ .05) very successfully and all indicators significantly loaded in their respective factors (see table 2).

Table 2. Means, Standard Deviations, Factor Loadings, Error and R^2 in Observed Variables (Standardized solution)

Variable	M	SD	Factor Loading	Error	R^2
Self-Efficacy					
Parcel 1	5.33	1.17	.55	.84	.31
Parcel 2	4,87	1.19	.73	.69	.53
Parcel 3	4.71	1.34	.77	.64	.60
Parcel 4	4.52	1.32	.72	.69	.53
Outcome Expectations					
Parcel 1	5.67	1.21	.84	.55	.70
Parcel 2	5.96	1.20	.89	.45	.80
Parcel 3	5.79	1.22	.84	.55	.70
Interest					
Parcel 1	5.17	1.27	.78	.63	.60
Parcel 2	4.94	1.32	.83	.55	.70
Parcel 3	5.07	1.22	.77	.64	.60
Parcel 4	5.06	1.29	.79	.61	.62
Occupational aspirations					
Parcel 1	3.84	1.60	.87	.49	.76
Parcel 2	4.08	1.67	.90	.44	.80
Parcel 3	3.82	1.67	.86	.51	.74
Social Support					
Item 1	5.16	1.74	.56	.81	.34
Item 2	5.81	1.61	.67	.74	.45
Item 3	5.48	1.70	.65	.76	.42
Item 4	5.64	1.68	.73	.69	.53

Note. Score range for all variables is 1-7. All factor loadings are statistically significant at the $p<.05$ level

Loadings ranged from .55 (parcel 1 of self-efficacy) to .90 (parcel 2 of occupational aspirations), but only four out of eighteen variables showed a loading lower than .70. Correlations among latent variables are included in Table 3.

Table 3. Correlations among Latent Variables

	1	2	3	4	5
1. Self-Efficacy	-	.34	.67	.40	.34
2. Outcome Expectations		-	.47	.33	.59
3. Interests			-	.63	.44
4. Occupational aspirations				-	.35
5. Social Support					-

Note. All correlations are significant at the .05 level

The structural model also produced a good fit to the data (again CFI ≥.95 and RMSEA ≤ .05). In fact, the structural model did not differ from the measurement model on the ΔCFI criterion (ΔCFI=.01), although ΔS-Bχ^2 was significant (see Table 1).In order to evaluate the stability of the results, the model estimation was replicated on a random sample of 50% of participants (n=1394). Fit indices values represented also an adequate model-to-data fit in this subsample (see table 1).

All the paths hypothesized in the model were significant, with standardized coefficients of moderate to large magnitude, except two (see Figure 2). The only non-significant coefficients were for the direct paths from self-efficacy to occupational aspirations and from outcome expectations to occupational aspirations. However, the indirect effects hypothesized did prove statistically significant (see Table 4).

The R^2 values in Figure 2 represent the proportion of variance in each dependent latent variable that is explained by the factors in this model. Collectively, the predictors accounted for 52% of variance in interests and 40% of the variance in occupational aspirations.

Table 4. Standardized indirect and total effects

Predictor	Criterion	Indirect Effect	Total Effect
Self-efficacy	Interests	.04	.62
	Occupational Aspirations	.39	.34
Outcome Expectations	Occupational Aspirations	.17	.19
Social Support	Outcome expectations	.05	.59
	Interests	.38	.38
	Occupational Aspirations	.23	.29

Note. All parameters are significant at $p<.05$

3.3. Multi-group analyses

Separate covariance matrices were used to conduct multi-group analyses between male (n=1300) and female (n=1483). In addition, a multi-group analysis was used

to test invariance across ethnic groups: white Colombians (n=628), mestizo Colombians (n=994), and Afro-Colombians (n=1068). In both analyses, two hypotheses were tested: (a) equal number of factors and item loadings, and (b) equal number of factors, item loadings, and path coefficients among latent factors. This was done by developing two nested versions (restrictive and unrestrictive) of the measurement and structural nested models. If the most restrictive nested model fits the data as well as the least restrictive model, then there is support for the invariance of the constrained parameters. The usefulness of testing unconstrained measurement models stems from their role as a baseline model. In multi-group comparison, failure to support the first hypothesis about *configural invariance* (Meredith, 1993) suggests that the constructs are being mapped differently across groups. If configural invariance is supported, a more restricted model can be used. When cross-group metric invariance constraints have already been placed on factor loadings, invariance constraints on the factor regression coefficients in the structural model can be tested. If path coefficients among latent factors are the same across groups, the latent causal process being modeled can be considered as similar across groups.

The satisfactory fit shown in Table 1 for the unconstrained measurement model by gender indicates that the proposed model did not differ across groups with regard to the number of factors (CFI $\geq$.95and RMSEA $\leq$ .05). Configural invariance was thus supported. The fit of the constrained and unconstrained measurement models was then compared. As an identical CFI index was obtained for both measurement models (CFI=.97) the pattern of factor loadings appears to be equivalent across gender (ΔS-Bχ2 was also not significant). The constrained structural model did not differ from the unconstrained structural model on the ΔCFI criterion (ΔCFI=.00), although ΔS-Bχ2 was significant. As ΔCFI was considered the main criterion in this study, these results indicated that structural paths are invariant across gender.

The comparison by ethnic group (Table 1) indicated that the measurement models both produced adequate (CFI $\geq$.95 and RMSEA $\leq$ .05) and comparable fit indices to the data (ΔCFI= .00), suggesting equivalence across groups in number of factors and item loadings. Finally, the difference in fit between the constrained and unconstrained structural models was not significant (ΔCFI= .00; p [ΔS-Bχ2] >.05). These results suggest that structural paths are invariant across ethnic groups.

4. Discussion

The general objective of the study was to evaluate the core of SCCT interest and choice model with Colombian secondary students in the scientific and mathematical field. Additionally its validity was examined for male and female students and for different ethnic groups, with a view to verifying whether the causal relationships established between the different socio-cognitive constructs operate in a similar way when dealing with people belonging to ethnic minorities (e.g. Afro-Colombians). As the model produced a good fit to the data in all the samples considered, the overall results supported the usefulness of this theoretical framework to explain the processes of vocational development of Colombian students irrespective of gender and ethnicity.

According to the SCCT interest model, math/science self-efficacy and outcome expectations directly predicted interests (hypothesis 1). Self-efficacy also appeared

to influence outcome expectations and affect math/science interests through outcome expectations (hypothesis 2).The choice model of Lent et al. (1994) also appeared to be at least partially applicable to the Colombian secondary students, given that math/science interests directly affected occupational aspirations (hypothesis 3) and self-efficacy and outcome expectations indirectly affected occupational aspirations (hypothesis 4). However, the direct effects of self-efficacy and outcome expectations were not significant with respect to occupational aspirations.

The non-significant path from self-efficacy to occupational aspirations/goals is consistent with some prior research in the STEM domain (Garriot, Flores & Martens, 2013; Jian & Zhang, 2012). Lent, Brown, Nota et al. (2003) and Lent, Da Silva, Paixão & Leitão (2010) also found significant paths between self-efficacy/goals constructs in some of Holland's six RIASEC themes but not in others. In these two studies, one anomalous finding was that the self-efficacy-goals path was negative in some themes, as we have also observed ourselves. As the correlation between the two latent variables was positive and large also in the present study (.40), the negative path is likely to be the result of statistical suppression. This combination of results suggests that, although interests could mediate the relationship between self-efficacy and occupational aspirations, this effect may vary according to the content of the area assessed. It should be noted in this connection that self-efficacy has a considerable indirect effect on the occupational aspirations in this study.

We also found that outcome expectations did not produce a significant direct effect path to occupational aspirations. Although this result differs from the most frequent findings in research into SCCT with secondary students, Lent et al. (2011) noted that some inconsistencies in this path can be identified from prior research with STEM university students. Indeed, some studies with engineering and computing students found outcome expectations did not directly predict goals. By contrast, outcome expectations have been useful predictors of choice in other research with STEM students (e.g., Quimby, Seyala & Wolfson, 2007). The reasons for these inconsistencies in the predictive utility of outcome expectations are unclear, but the definition of the measurement of expectations could be an important cause (Lent et al., 2011).

Nevertheless, our results did clearly confirm the predictive value of perceived social support in the model (Hypothesis 5). Firstly, consistent with previous research with secondary students(e.g. Garriot, Flores & Martens, 2013) and university students (e.g. Lent et al., 2011), an important direct influence of perceived support on self-efficacy was identified, as well as a clearly smaller direct effect on occupational consideration. Modest values for the direct effect of social support on occupational intentions (lower than .10) have been also found for Italian secondary students (Lent, Brown, Nota & Soresi, 2003), Portuguese secondary students (Lent, Paixão, et al., 2010) and Mexican American secondary students (Navarro, Flores & Worthington, 2007). Secondly, our results supported the hypothesis put forward by Sheu et al. (2010), which links perceived social support to outcome expectations. Finally, the findings of the present study support the idea that the relation of contextual variables to goals is mediated by outcome expectations as well as by self-efficacy, because in addition to direct effects, social support produces very important indirect effects on interests and occupational aspirations.

Collectively, the predictors in the abbreviated 5-variable model tested in the present study accounted for a substantial proportion of the explained variance of interests and occupational aspirations when compared with the results of past research on SCCT in math and science-intensive fields as well as in other areas (see Garriot, Flores & Martens, 2013; Sheu et al., 2010). The findings also indicate that the predictive usefulness of social cognitive variables is not moderated by gender or by ethnic group (hypotheses 6 and 7). That is, SCCT variables may help explain math/science interests and occupational aspirationsof male and female Colombian students and among white, mestizo and Afro-Colombian students. The results obtained in this study referring to the Afro-Colombian minority are thus consistent with most of the research carried out in the United States with Afro-American students (Lent & Sheu, 2010).

Although the overall results of this study encourage us to continue doing research into the usefulness of SCCT to understand and foster the vocational development of Colombian students, the findings presented should be interpreted in the light of some of its limitations. Firstly, although the sample was large, it was not selected from the population on a random basis and consisted mainly of students in public schools, so that caution must be exercised in any generalization of the results. Moreover, the majority of students were in the age range 14 to 16, which should also be borne in mind. Secondly, as the evaluation of the SCCT model was carried out specifically in the area of science and mathematics, its results cannot be generalized to other areas. In addition, as an abbreviated model was analyzed, mainly focusing on the core of the SCCT model, only limited evidence is provided concerning other relevant socio-cognitive variables. Finally, as the design proposed was transversal the results cannot be interpreted in strictly causal terms.

However, these limitations point to possible future areas of research. It thus seems opportune and relevant to evaluate SCCT in new representative samples, including students enrolled in the final courses of the secondary education, and in areas other than science and mathematics, with a view to verifying whether the results obtained here can be generalized wholly or partly to the general secondary population and to other fields. In addition, it could be useful to replicate this study with samples of secondary students in other countries in the region, with a view to verifying its explanatory capabilities in the wider Latin American context. Once reasonable evidence is available regarding the fit of the core of the SCCT model in this context, future research should also analyze more complex models, which include other variables such as perceived social barriers and experiences of learning that determine self-efficacy and outcomes expectations. Finally,longitudinal studies are necessary to draw conclusions regarding causality.

These preliminary results allow us to value this theoretical framework positively as a possible basis for the design of educational initiatives that will have a positive effect on processes of vocational development among Colombian secondary students in the fields of science and mathematics. Such initiatives should be geared to encouraging self-efficacy and positive outcomes expectations in the area and stimulating the social support needed for students to select and persist in scientific and mathematical careers.

In conclusion, the present findings support the use of SCCT to explain and predict the process involved in the development of math/science interests and choice of goals in Colombian secondary students. These results contribute to SCCT research by extending empirical evidence about interest and choice models across cultural

settings, encourage further research in the area and can provide patterns for the design of interventions in the area of career development.

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