Articles

Spanish-language Version of the Science Identity Survey (SISE): Translation, Cultural Adaptation, and Evaluation

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Abstract

Multiple worldwide efforts, including research experiences and internships for students, have been developed to increase diversity in STEM. In order to understand the outcomes of these research experiences, instruments have become available, but surprisingly, Spanish instruments for these purposes are scarce. The evaluation of diverse scientific experiences and their influence on science identity is imperative. For this reason, we aimed to translate, and evaluate a Science Identity Survey for Puerto Rican high school students. A committee of experts evaluated the original survey of Science Identity and it was translated to Spanish using back-translation. Think-aloud results revealed that students' perception of their: (1) science competence is based on their grades, understanding, knowledge, and learning; (2) performance is based on design and completion of a scientific task; (3) recognition is based on the value that others give to science. The survey was analyzed to determine its dimensionality and reliability. A Cronbach's alpha of .857 was obtained, which suggests that the items have a good internal consistency. Exploratory factor analysis was performed and three factors; competence, performance and recognition were retained. This version of the survey was deemed to be an appropriate instrument to address student science identity.

Keywords science identity, high school students, Spanish translation, quick assessment, scale

Introduction

A recurring global issue in Science, Technology, Engineering and Math (STEM) education is the poor academic performance and retention of students. (Sithole et al., 2017; Therriault et al., 2017). Multiple worldwide efforts, including research experiences and internships for students, have been provided to increase diversity in STEM. (Eeds et al., 2017; Laursen et al., 2010, 2015; Lopatto, 2010). In order to identify program outcomes and define gains, multiple surveys have been developed (Corwin et al., 2015; Hanauer and Dolan, 2017; Lopatto, 2004, 2010; Weston and Laursen, 2015) and a growing body of research has been reported (Bauer and Bennett, 2003; Hathaway, 2002; Kardash, 2000; Kremer and Bringle, 1990; Lopatto, 2004, 2007; Lopatto and Tobias, 2010; Russel, 2007). Some examples of developed surveys and instruments are the Classroom Undergraduate Research Experience (CURE) survey, Survey of Undergraduate Research Experiences (SURE), Laboratory Course Assessment Survey (LCAS), Project Ownership Survey (POS) and Undergraduate Research Student Self-Assessment (URSSA).

While each of the aforementioned surveys measure research experience outcomes, each of them evaluates the experience within a particular theoretical framework. For example, the project ownership survey (POS) measures project ownership, and positive emotions towards the experience of the laboratory course (Hanauer and Dolan, 2017). The

CURE survey focuses on measuring the outcomes of research experiences by using a pre-course survey, a post-course survey, and an instructor report of course elements (Lopatto, 2010). The pre-course survey is focused on student level of expertise, science attitude, and learning style. The post-course survey estimates cognitive gains and benefits as well as attitude towards science. The SURE survey focuses on gains in laboratory technical skills, independence, intrinsic motivation, active participation and personal skills (Lopatto, 2004). LCAS measures students' perceptions of biology lab courses; in particular it is focused on collaboration, discovery, relevance, and iteration (Corwin et al., 2015). URSSA measures personal gains related to research work, skills, attitudes and behaviors, as well as thinking and working like a scientist (Weston and Laursen, 2015). The data gathered with these instruments and other research strategies has found that undergraduate research allows students to acquire beneficial learning and personal gains such as concept understanding, thinking like scientists, elucidation of what they want to study, and whether to further pursue graduate education, specifically in STEM.

Although these instruments comprised multiple important factors that influence research experiences and persistence of different populations including Latino/Hispanic populations, the impact of scientific experiences on the science identity of Latino/Hispanic high school students remains incompletely defined. Due to the increasing population of high school students whose first language is Spanish, it is critical to understand the science identity of them taking into consideration culturally-patterned differences, native language, and familiar concepts to obtain a better understanding of their science identity (Ramirez et al., 2017). Since diversity and inclusion of everyone into science, including the Latino/Hispanic population, is important for the nation's economic and social development, the study of science identity and key components for retention is imperative (Malcom and Feder, 2016). Unfortunately, in a review of the literature, no single validated Spanish-language assessment instrument for science identity was found.

Identity as described by Gee (1991) is "the kind of person one is seeking to be and enact in the here and now". When it comes to science identity, researchers agree that there is a component of self or intrinsic factors and a component of fitting into the norms and practice of the scientific community that leads to the recognition of the person in the specific community. A growing amount of research has argued that the components that build up students' science identity offers "the most complete understanding of students' trajectories and persistence in science related careers" (Fraser and Ward, 2009; Krogh and Andersen, 2013). Although science identity has taken many different meanings, we will focus on the definition given by Carlone and Johnson (2007) because of their methodological and practical implications. This selection does not deny other useful approaches that could be taken using other definitions; it gives us a framework for data analysis and interpretation.

Carlone and Johnson's approach to define and contextualize a science identity model is formed by the following question: "How would we describe a person who has a strong science identity?" They define the science identity concept as the kind of person that "makes visible to (performs for) others one's competence in relevant practices, and, in response, others recognize one's performance as credible" (2007). In other words, their science identity model captures the key elements that build and describe a person that belongs to the scientific community. Interestingly, this model is based on the interrelated dimensions of competence, performance and recognition that an individual can envision at different degrees and configurations (Carlone and Johnson, 2007). Competence is defined as "knowledge and understanding of science content"; performance is defined as "social performances of relevant research practices such as: ways of taking and using tools"; and recognition by "recognizing oneself and others as a "science person" (Carlone and Johnson, 2007).

Multiple researchers have developed surveys addressing science identity (Cole, 2012; Estrada et al., 2011; Hanauer, et al. 2016; Schon, 2015; Stets et al., 2016; Vincent and Schunn, 2018). These instruments attempt to define science identity using the following constructs: self-identification, performance, recognition, students' interests related to science, reflected appraisals, science self-efficacy, science behavior, interest, fascination, values, competency beliefs, project ownership, emotion, and networking. Among the surveys that study students' science identity and follow the structure and specific dimensions of Carlone and Johnson is Jennifer Schon's Science Identity Survey (SIS) (Schon, 2015). The SIS instrument measures intrinsic and extrinsic components of science identity using 15 items. Although the SIS instrument measures competence using knowledge and understanding of science topics, these items are not content-based and therefore can be used for the evaluation of interventions of a wide range of topics. Its length and approach make this instrument suitable for the evaluation of a variety of short interventions. Therefore, we have selected this survey to study high school students' science identity.

The SIS was translated, contextualized, and evaluated (Schon, 2015) with Spanish-speaking, Puerto Rican high-school students as research subjects. Survey evaluation was conducted following amixed method approach, as the one performed by the original SIS developers (Schon, 2015).

SIS development and use

The SIS was created to evaluate the impact of students' experiences at informal education centers (Schon, 2015). Since informal education experiences, such as museums, afterschool programs, and activities in off-school venues differ in style, context, and content, the developers of the survey created a short non-content based survey to evaluate students' experiences based on a mixed method approach (Schon, 2015). First, interviews were held to gather insight on student's scientific experiences. Items were then constructed, followed by think-aloud and pilot testing (Schon, 2015).

The three different dimensions or constructs of science identity described by Carlone and Johnson: competence, performance, and recognition were included and studied in the SIS. The competence category consists of 5 items that are related to student perception of knowledge and learning. Performance consists of 5 items based on student perception of science skills as experimental design, making observations, and using the scientific method. Recognition includes 5 items that identify if the students feel like a scientist or if they perceive that friends or relatives see them as scientist. For each of these categories, a 5 to 1 Likert scale from "Strongly agree" to "Strongly disagree" was used.

The original instrument was used for 5th and 6th grade students at the University Of Idaho College Of Natural Resources' McCall Outdoor Science School (MOSS). For the confirmatory factor analysis, they report the following indices: comparative fit index (CFI) = .934, adjusted goodness of fit index (AGFI) = .869, root mean square error of approximation (RMSEA) = .07, standardized root mean squared residual SRMR= .065. This instrument was further used to evaluate students' science identity before and after an informal education experience at MOSS. Also, a follow up evaluation was performed after a month. Results showed that the experience at MOSS was a positive influence on the participants' science identity (Schon, 2015).

Methods

Participants

The Institutional Review Board at the University of Puerto Rico approved this study (IRB protocol 1718-036). Participants did not receive any incentive for their participation. Anonymity of all participants is guaranteed. We selected participants based on their grade level (10th, 11th and 12th grade), and availability and willingness to complete the survey. An informative brochure of the study together with the consent/assent form was given to students. Two weeks after the initial approach, consent/assent forms were collected and during the same day, participants answered the survey or participated in interviews. Survey content evaluation was addressed using the think-aloud method (Trenor et al., 2011). One group of three and another of four students participated in this process to confirm that participants understood the intended meaning of the questions. A preliminary evaluation was performed with 32 participants (19 females and 12 males) from one school located in San Juan, Puerto Rico. For the construct evaluation, three different high schools from the San Juan region were approached. The participants' schools where selected according to their specialization (science, sports, or languages) in order to include students with a diverse range of interests. A total of 180 participants completed the survey.

Translation

The SIS was translated from English to Spanish as suggested by the World Health Organization guidelines (2007). A bilingual translator, who was familiar with science identity constructs, and whose mother tongue is Spanish performed the forward-translation step. Once the initial translation was completed, a bilingual panel composed of 4 experts in the field of science, education, translation, and/or instrument development discussed each item. The expert panel evaluated each item for discrepancies between the original version and the translated version, cultural discrepancies, concept translation, jargon, and clarity. Once the expert panel solved discrepancies and reached a consensus on all items, the revised Spanish version was given to an independent translator whose mother tongue is English and did not have any knowledge of the studied concepts of science identity. The independent translator translated the Spanish version of the survey back to English (backward translation). Subsequently, the expert panel compared the English version of the survey to the original version and discrepancies were discussed until conceptual and cultural equivalence of the survey was achieved. Each panel discussion took approximately 4 hours.

Survey content evaluation

The final version of the translation process was given to groups of 4 participants as suggested by Virzi (1992). Participants were asked to answer: (1) what was their first thought about the item, (2) what was their answer, (3) if something was not clear, and if so, what was not clear to them, and (4) if they had a suggestion to improve the item. Participants evaluated each item and their suggestions were incorporated in the survey. The final version of this process was a consensus among all the participants. At the end of the process, the interviewer read out-loud the survey and final changes, or suggestions were incorporated. This process was repeated until it reached saturation of responses (Trenor et al., 2011).

Survey construct evaluation

Think-aloud suggestions were incorporated into the survey and administered to participants. During this process we realized that the numbered Likert scale was not clear to participants. For this reason, we incorporated another session of think-aloud with 4 additional participants, in which two versions of the survey were given, one with a scale labeled with numbers and another one labeled with descriptive word answers. Participants were asked to answer the survey in both formats and talk about their answer selection process allowing us to define and correct any misconception and select the best scale format for our survey.

The survey was administered to 180 participants. Survey descriptive statistics, reliability, and goodness of fit analysis were calculated using IBM SPSS Statistics software package, version 24. Cronbach's alpha was used to estimate the internal consistency of the survey (Cronbach, 1951). Measurement criterion was as followed: $\alpha \geq 0.90$ (high internal consistency or items may be redundant) $\alpha \geq .80$ (good internal consistency) $\alpha \geq .70$ (adequate internal consistency) (Nunnally, 1978). Skewness and kurtosis acceptable criterion for normality was set at $|2.0|$ as suggested by George D. and Mallery P. (2010). Kaiser-Meyer-Olkin, measure (KMO) of sampling adequacy threshold was set at 0.5 as used by Hanauer and Dolan (2014).

Students' perceptions of their competence, performance and recognition are variables that cannot be directly observed (latent variables). To study these unobservable variables, we analyze participants' responses to specific questions (measurable variables) to make inferences about the studied latent variables. Exploratory Factor Analysis (EFA) with principal axis extraction method was selected instead of the Principal Components Analysis, because we wanted to determine interpretable constructs that explain correlations among measurable variables and not in find components that explain as much variance as possible (Preacher and McCallum, 2003; Knekta, Runyon and Eddy, 2019).

To identify the best structure to interpret our results we rotated the factor solutions. Among the rotation methods that are available we selected the oblimin method, which allowed correlation among factors (Preacher and McCallum, 2003). Parallel analysis was performed to determine the number of factors to retain; Principal Axis Factor was used as the method of extraction, 1000 data sets, 95 percentile, and Pearson correlation (O'Connor, 2000).

Characteristics		Number students
Age range	14-17	
Female		93 (1.6%)
Male		86 (48%)
Other		1 (0.5%)
Metropolitan area of San Juan*		155 (86%)
Other#		25 (14%)

Table 1. Student demographics. *including Bayamón, Carolina, Cataño, Guaynabo, and Trujillo Alto. # Corozal, Gurabo, Toa Baja, Aguas Buenas, Dorado, Juncos, Las Piedras, Vega Alta, San Lorenzo, Río Grande, Canóvanas.

Results

Participants

Participants' age ranged from 14 to 17 years old (Table 1). The proportion of females and males was fairly evenly distributed, but overall more females participated. Most of the participants live in the metropolitan area of San Juan, Puerto Rico. As it is shown in Tables 2 and 3, some participants failed to indicate their parent's highest degree obtained, field of study, and/or occupation because they had no knowledge about this information, declined to answer,

Education	High School	Two-year Associate	Bachelor's Degree	Post-graduate or Professional Degree*	N/A+
Father highest degree obtained	9 (5%)	5 (3%)	57 (32%)	57 (32%)	52 (29%)
Mother highest degree obtained	24 (13%)	5 (3%)	38 (21%)	42 (23%)	71 (39%)

Table 2. Parents highest degree obtained. *including master's, doctorate, medical or law degree. +don't know/refused to answer.

	N/A+	STEM	Other
Father field of study	68 (38%)	33 (18%)	79 (44%)
Mother field of study	37 (21%)	36 (20%)	107 (59%)
Father occupation	32 (18%)	27 (15%)	121 (67%)
Mother occupation	31 (17%)	23 (13%)	126 (70%)

Table 3. Parents field of study and occupation. +don't know, refused to answer, unemployed.

or left unanswered because it didn't apply to their case. From the participants who answered, most of their parents obtained a postgraduate or professional degree (includes Master's, Doctorate, Medical, or Law degrees). A few participants had parents who graduated from Associate degree programs. Most parents studied in a field and/or have an occupation that is not related to STEM.

Content evaluation

Two groups of four participants discussed each item of the Spanish-translated version of the survey, suggesting a total of 8 changes, all of which were incorporated (Table 4). Changes were mainly focused on verb usage and the inclusion of not just task, but projects in item number 12. Participants also requested to delete "mis" ("my") on item number 13, (Las personas me ven como un científico cuando comparto

Original questionnaire	Translated questionnaire	Incorporation of think-aloud suggestions
1. I am good at science	Soy bueno en ciencia.	Soy bueno en ciencia.
2. I know a lot about science	Se mucho de ciencia.	Se mucho de ciencia.
3. I am good at most science experiments	Soy bueno haciendo experimentos científicos.	Soy bueno llevando a cabo experimentos científicos.
4. I understand science topics	Entiendo fácilmente los temas de ciencia.	Domino los temas de ciencia.
5. I learn new science topics easily	Aprendo fácilmente nuevos temas de ciencia.	Aprendo fácilmente nuevos temas de ciencia.
6. I can use science equipment and/or technology to collect data	Puedo usar equipos científicos y/o tecnología para obtener datos.	Puedo usar equipos científicos y/o tecnología para obtener datos.
7. I know how to use the scientific method/process	Se cómo usar el método científico.	Se cómo usar el método científico.
8. I can talk with others about science related topics	Puedo hablar con otras personas sobre temas de ciencia.	Puedo hablar con otras personas sobre temas de ciencia.
9. I can create my own science experiments	Puedo crear mis propios experimentos científicos.	Puedo diseñar mis propios experimentos científicos.
10. I can use my observations to create a hypothesis	Puedo usar mis observaciones para hacer una hipótesis.	Puedo usar observaciones para hacer una hipótesis.
11. My friends see me as someone that is good at science	Mis amigos me ven como una persona que es buena en ciencia.	Mis amigos me ven como una persona que es buena en ciencia.
12. When giving a science report, I feel like a scientist	Cuando hago mis trabajos de ciencia, me siento como un científico.	Cuando hago trabajos y/o proyectos de ciencia, me siento como un científico.
13. Others see me as a scientist when I share my observations	Las personas me ven como un científico cuando comparto mis observaciones.	Las personas me ven como un científico cuando comparto observaciones.
14. When I share data I've collected, I feel like a scientist	Cuando comparto los datos que he obtenido me siento como un científico.	Cuando comparto los datos que he obtenido me siento como un científico.
15. I can help others with science related topics	Puedo ayudar a las personas cuando tienen dudas de ciencia.	Puedo ayudar a las personas cuando tienen dudas de ciencia.

Table 4. Translation of the items and the result of think-aloud process. Translation of the Science identity questionnaire published by Jennifer Schon was performed using back-translation followed by a committee expert evaluation. Think-aloud was performed twice using a group of 3 to 4 students.

"mis" observaciones) since they feel like scientists when they are sharing observations of other scientists as well as their own.

Participants also commented that the numbered scale is subjective, and the descriptive scale is clearer to them. From the think-aloud interviews we gathered the following participants' quotes (see translated English version at the bottom of each quote):

"Me enfrento a la escala de palabras y mi humildad toca la puerta. En la escala de palabras valgo menos."

"When I am confronted with the words scale my humility knocks on the door. With the words scale I feel of less value"

"Es más claro (en palabras), número es más subjetivo."

"It is clearer (in words), numbers are more subjective"

"Palabras es más claro".

"With words it is clearer."

"Con números la interpretación es diferente; es subjetivo."

"With numbers the interpretation is different; it is subjective"

Therefore, the following descriptive word scale was incorporated: "Muy de acuerdo", "De acuerdo" Ni en desacuerdo ni de acuerdo", "En desacuerdo", and "Muy en desacuerdo". The modified version was administered to 180 participants for construct evaluation.

Answers mean value for the items ranged from 2.8 to 4.3 (Table 5). All the items had a skewness and kurtosis below |1.0|. Intra-subscale correlations ranged from 0.325 to 0.724 and communalities range from 0.463 to 0.785. Results show a Chi-Square, value of 1125.633 significance 0.000, Cronbach's alpha coefficient value of 0.867, and Kaiser-Meyer-Olkin, measure (KMO) of sampling adequacy of .855. Also, a Bartlett's test of sphericity, tests of correlation matrix, showed a significance of 0.000. After the analysis and interpretation of the measurements above

Item	Mean	Std. Deviation	Skewness	Kurtosis	Corrected Item-Total correlation
1	3.8	0.84313	-0.528	0.664	0.602
2	3.4	0.7907	-0.015	0.271	0.591
3	3.9	0.82827	-0.402	-0.31	0.438
4	3.6	0.79451	-0.386	0.793	0.615
5	3.7	0.84643	-0.379	0.184	0.568
6	4.2	0.72541	-0.759	0.689	0.473
7	4.2	0.69171	-0.318	-0.501	0.325
8	3.9	0.89872	-0.571	-0.349	0.503
9	3.4	0.92727	-0.089	-0.326	0.406
10	4.3	0.60051	-0.208	-0.573	0.355
11	3.4	1.06871	-0.242	-0.448	0.724
12	3.4	1.14525	-0.265	-0.678	0.374
13	2.8	0.92244	-0.027	-0.033	0.59
14	3.2	1.13551	-0.146	-0.769	0.491
15	3.7	1.01882	-0.651	0.176	0.661

Table 5. Descriptive statistics for each of the items. n=180

Number of items	15
Number of responses	180
Average inter-item correlations	0.306
Standard deviation of Inter-item correlations	0.15
Cronbach's alpha	0.867
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.855
Bartlett's Test of Sphericity	1125.633
Bartlett's Test of Sphericity Significance	0

Table 6. Scale and Reliability Statistics of the survey. 15 items, n=180

Component Matrix					
Item	1	2	3	4	Total variance explained
Soy bueno en ciencia.	.873				5.492 (33.71%)
Se mucho de ciencia.	.701				
Domino los temas de ciencia.	.699				
Aprendo facilmente nuevos temas de ciencia.	.654				
Puedo ayudar a las personas cuando tienen dudas de ciencia.	.590				
Mis amigos me ven como una persona que es buena en ciencia.	.565			-.402	
Cuando hago mis trabajos de ciencia, me siento como un cientificico.		.950			1.834 (10.174%)
Las personas me ven como un cientifico cuando comparto mis observaciones.		.801			
Cuando comparto los datos que he obtenido me siento como un cientifico.		.659			
Se cómo usar el método cientifico.			.704		1.478 (96.083%)
Soy bueno llevando a cabo experimentos cientificos			.539		
Puedo usar equipos cientificos y/o tecnologia para obtener datos.			.494		
Puedo usar observaciones para hacer una hipótesis.			.419		
Puedo hablar con otras personas sobre temas de ciencia				-.643	1.02 (3.35%)
Puedo diseñar mispropios experimentos cientificos.				-.431	

Table 7. Exploratory factor analysis. Using Oblimin rotation, four factors were found that explained 53.32% of the variance.

mentioned and descriptive statistics we confirmed that the sample was adequate and that its dimensionality could be explained using a factor analysis (Table 6).

The internal structure of the test items was identified using the exploratory factor analysis. Principal axis factoring using the oblimin with Kaiser normalization rotation was conducted. Results indicate a 4-factors solution (Table 7). The 4-factor solution explained 53.32% of the variance. Each item was explained by one factor, with the exception of item 11. Factor 1, which accounts for 33.71% of the explained variance, was constructed of competence and recognition items. Factor 2 (10.174% variance explained) was constructed of recognition items. Factor 3 (6.083% variance explained) was constructed of performance and one item of competences. Factor 4 (3.357% variance explained) was constructed of performance items.

In general, these factors were consistent with what was originally described for the SIS. In detail, the first factor, that comprised mainly competence items, included the following items that were previously categorized in the recognition dimension: "Mis amigos me ven como una persona que es buena en ciencia" (SIS original item: "My friends see me as someone who is good at science"), and "Puedo ayudar a las personas cuando tienen dudas de ciencia" (SIS original item: "I can help others with science related topics"). In the think-aloud, participants commented that in order to help others and to be recognized as a person that is good at science, they needed to know the material and have good grades. Thus, they related these items to their ability to understand and know science topics , which directly associates to science competencies.

The third and fourth factors are mainly composed of performance items. One item previously included in the competence dimension: "Soy bueno llevando a cabo experimentos científicos" (SIS original item: "I am good in most science experiments") was incorporated in the third factor. Participants' interpretation of this item focused on experimental design, methods, and experimentation. Participants emphasized that the item is open enough that it can be interpreted as experimental design or experimentation. The fourth factor was composed of two performance items. According to the parallel analysis and because of the small number of items in factor 4, just factors 1, 2 and 3 were retained (Figure 1).

Based on the exploratory factor analysis, parallel analysis, and think-aloud comments we recommended a rearrangement of the items on each of the dimensions and the deletion of original items 8, 9, and 11. Cronbach's alpha index was re-calculated for the final version of the survey and we obtained a result of .857. The final version of the survey is presented in Table 8 and it has incorporated the aforementioned modifications.

Discussion

Although science identity has been mainly studied in undergraduates or higher degrees, it is known that high school science identity is influenced by students' persistence, the role of the community, and level of science at school (Aschbacher et al., 2009). Unfortunately, the impact of scientific experiences on the science identity of Latino/Hispanic high school students remains relatively undefined (Gándara, 2006; Rochin and Mello, 2007; Tabak and Collins, 2011). To characterize the effectiveness of research experiences and identify which components actually are important for STEM retention of high school Latino/Hispanic population, an assessment in Spanish was necessary. This study presents evidence of the translation and evaluation of the Spanish version of the SIS (SISE, for SIS-Español), using Puerto Rican high school students as research subjects and takes into consideration culturally patterned differences.

After the think aloud process, participants agreed that the numbered Likert scale was subjective, and the descriptive word scale was more informative. For this reason, the original numbered scale on the SIS was replaced and the word descriptive scale was incorporated. This result is consistent with previous research on scales that found that numbered scales are subjective to participant interpretations and are more problematic for respondents that do not tolerate ambiguity (Johnson et al., 2005). Interestingly, our results show that participants tend to assign higher scores when using the numbered scale

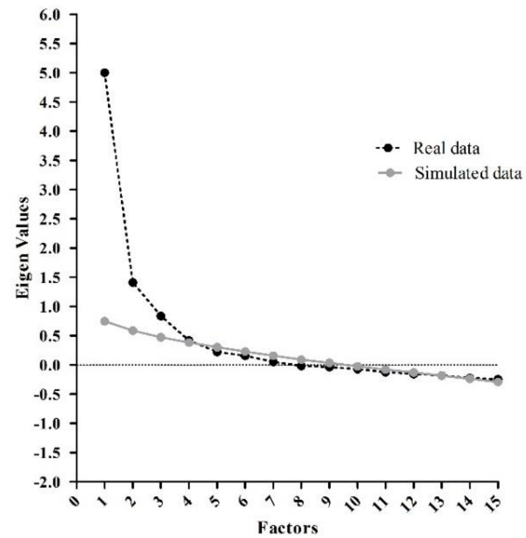

Fig 1. Parallel analysis. Method of extraction: Principal Axis Factor, 1000 data sets, 95 percentile, and Pearson correlation.

	Muy de aucerdo	De acerdo	Niem desacuerdo nide acuerdo	Em desacuerdo	Mu yen desacuerdo
1. Soy bueno en ciencia.					
2. Se mucho de ciencia.					
3. Soy bueno hacienda experimentos cientificos.					
4. Entiendo fácilmente lose mas de ciencia.					
5. Aprendo fácilmente nuevos temas de ciencia.					
6. Puedousar equipos cientificos y/o tecnologiia para obtenere datos.					
7. Se cómo usar elmétodo cientifico.					
8. Puedo usar observaciones paraq hacer una hipótesis.					
9. Cuando hago mis trabajos de ciencia, me siento como un cientifico.					
10. Las personas me ven como un cientifico cuando compartomi observaciones.					
11. Cuando comparto los datos que he ob tenido me siento como un cientifico.					
12. Puedo ayudara las peronsasw cuando tienen dudas de ciencia.					

Table 8. SISE Suggested changes

than when they are using the descriptive word scale. This effect may be influenced by the submissive response (simpatía) style documented among Latinos and Hispanics (Johnson et al., 2005). Our results suggest that the use of a descriptive word scale can help participants to think about the best word that describes their answer and not on giving the highest score possible to each item.

After content evaluation and scale changes, an exploratory factor analysis and Cronbach's alpha index were calculated to explore the structure and reliability of the survey. A 4-factor solution was suggested, but one of the factors was not reliable. As a result, this factor was deleted.

Limitations and Suggestions

One limitation of the SIS is that its evaluation was performed using just one informal center. Given that participants of the SIS evaluation were self-selected, they may have a predisposition to science careers and this selection process excluded those students that may not like science and are not interested on a STEM career. To overcome this limitation, we chose schools specialized in various areas to have a diverse group of students with different levels of interests in science. We are aware that this selection does not imply or ensure participants' interest for science, but it does gather different student profiles. A potential limitation of the survey for future SISE users is that it has only been validated with Puerto Rican high school' students, and there are cultural differences across Spanish-speaking communities. We encourage future users of the SISE to validate this survey with a similar population to the one that will be further tested, taking into account culturally patterned differences and scale interpretations.

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Declaration of Interest

The authors declare no conflict of interest.

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