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The Self-Determination Inventory–Student Report: Confirming the Factor Structure of a New Measure

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Abstract

The *Self-Determination Inventory–Student Report* (SDI-SR) was developed to address the need in the field for new, theoretically aligned measures of self-determination. The purpose of this study was to establish the most robust and efficient set of items to assess the self-determination of adolescents with and without disabilities on the SDI-SR. Confirmatory factor analysis (CFA), using mean and covariance structures, was used to evaluate the factor structure of the SDI-SR to inform decisions on scale reduction. The items were tested across 20 groups generated by crossing disability (i.e., no disability, learning disability, intellectual disability, autism spectrum disorders, and other health impairment) and race/ethnicity (i.e., White, Black, Hispanic, and Other) groups. A robust set of 21 items that align closely with their associated constructs were identified. These 21 items showed strong measurement properties, including measurement invariance at the item level across the 20 groups. Implications for future research and practice are discussed.

Keywords

self-determination, high school, transition

Intervening to promote and enhance the self-determination of students with disabilities is recognized as best practice (Shogren, 2013; Test et al., 2009), given linkages to enhanced school and postschool outcomes (Shogren, Palmer, Wehmeyer, Williams-Diehm, & Little, 2012; Shogren, Wehmeyer, Palmer, Rifenbark, & Little, 2015; Wehmeyer et al., 2012). Increasingly, researchers have discussed the relevance of self-determination for all students. Teaching self-determination skills, including self-regulated problem-solving and goal-setting and attainment skills (Shogren et al., 2012), has potential applications for intervening to promote social-emotional learning in the context of multitiered systems of supports (Shogren, Wehmeyer, & Lane, 2016) and enhancing the attainment of core content and college and career readiness standards (Lombardi, Kowitt, & Staples, 2015) for all students. Causal Agency Theory (Shogren, Wehmeyer, Palmer, Forber-Pratt, et al., 2015) is a recently introduced theoretical framework for understanding the development of self-determination in adolescence. Causal Agency Theory defines self-determination as a

> . . . dispositional characteristic manifested as acting as the causal agent in one's life. Self-determined *people* (i.e., causal agents) act in service to freely chosen goals. Self-determined *actions* function to enable a person to be the causal agent is his or her life. (Shogren, Wehmeyer, Palmer, Forber-Pratt, et al., 2015, p. 258)

The introduction of Causal Agency Theory creates an opportunity and a need for the development of new assessments of self-determination. Causal Agency Theory builds on previous frameworks that have shaped assessment and intervention development in the disability field, specifically the functional model of self-determination (Wehmeyer, 1992). It, however, focuses on integrating emerging research from the fields of education and psychology that incorporates all students, including those with disabilities, particularly research in positive psychology related to strengths-based assessment and intervention (Lopez & Snyder, 2011) and motivational psychology with its emphasis on creating environments to facilitate autonomy, competence, and relatedness (Deci & Ryan, 2012; Niemiec & Ryan, 2009). Existing measures of self-determination developed in the early-1990s such as *The Arc's Self-Determination Scale* (Wehmeyer & Kelchner, 1995)

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Table 1. Causal Agency Theory.

Essential Characteristic	Component Construct	Sample SDI-SR item
Volitional Action	Autonomy	*I plan weekend activities I like to do.*
	Self-Initiation	*My past experiences help me plan what I will do next.*
Agentic Action	Pathways Thinking	*I come up with ways to reach my goals.*
	Self-Direction	*I think about each of my goals.*
Action-Control Beliefs	Control-Expectancy	*I have what it takes to reach my goals.*
	Psychological Empowerment	*I think trying hard helps me get what I want.*
	Self-Realization	*I know my strengths.*

Source. Reprinted with permission from Shogren (2017).
Note. SDR-SR = *Self-Determination Inventory–Student Report.*

and the *American Institutes for Research Self-Determination Scale* (Wolman, Campeau, Dubois, Mithaug, & Stolarski, 1994) are based on previous theoretical conceptualizations and have primarily been used in adolescents with disabilities. Shogren et al. (2017) reported on the initial development and testing of the measurement properties of a new assessment of self-determination, the *Self-Determination Inventory–Student Report* (SDI-SR) that was developed to align with Causal Agency Theory.

In its theoretical conceptualization of self-determination, Causal Agency Theory describes three essential characteristics self-determined *action*: Volitional Action, Agentic Action, and Action-Control Beliefs. *Volitional Action* involves self-initiation and autonomy or making an intentional, conscious choice based on one's preferences. *Agentic Actions* are defined by self-direction and pathways thinking and involve regulating one's progress toward goals, navigating challenges that emerge. Finally, *Action-Control Beliefs* emerge as people grow to understand and integrate understandings of the relationship between one's actions, the means involved, and the outcomes one experiences. People with adaptive Action-Control Beliefs act with positive control-expectancies, with self-realization, in a psychologically empowered way (Shogren, Wehmeyer, Palmer, Forber-Pratt, et al., 2015). Causal Agency Theory holds that the essential characteristics of self-determination develop throughout childhood and adolescence, as supportive contexts enable opportunities to practice skills that lead to the essential characteristics, and the component characteristics associated with each essential characteristic. Furthermore, various personal factors, including disability, gender, age, race/ethnicity, as well as various environmental factors, such as educational experiences and expectations, are expected to influence the development of self-determination. For example, researchers have consistently found that disability influences self-determination, with students without disabilities reporting higher levels than students with disabilities (Shogren, Lopez, Wehmeyer, Little, & Pressgrove, 2006), and students with learning disabilities reporting higher levels than students with intellectual disability (Shogren et al., 2007; Wehmeyer et al., 2012) and students with autism spectrum disorders (ASD; Chou, Wehmeyer, Palmer, & Lee, 2017).

The theoretical structure that undergirds Causal Agency Theory is summarized in Table 1. To generate items for the SDI-SR, experts in the fields of self-determination, positive psychology, and general and special education came together to create explicit operational definitions for each essential characteristic and component construct. These definitions provided guidance for item generation. Shogren et al. (2017) described the initial pilot testing of these items with the draft items ($n = 68$) being completed by 176 adolescents with and 135 adolescents without disabilities between the ages of 12 and 22 years. Shogren et al. reported that 18 items were eliminated because of low factor loadings, cross-loadings, or highly correlated residuals, resulting in 50 items that were evaluated for model fit, and measurement invariance across adolescents with and without disabilities. Overall, the remaining items functioned as expected and demonstrated strong model fit and invariance across students with and without disabilities, as well as differentiation across students with and without disabilities when looking at latent scores for the essential constructs. As hypothesized, students with disabilities scored lower across all three essential characteristics than did students with disabilities. The only exception was six items that assessed means-ends problem solving hypothesized to be associated with Agentic Action. These items, which provided a beginning and ending to a story and asked youth to fill in the middle, were the only items that deviated from the Likert-type rating scale used for the remaining items. There was limited variability in scores, particularly in the no disability group, and the items did not hang well with other items in the Agentic Action construct or the scale. The authors suggested that the use of the items and their rating scale be further considered in future research. They also recommended exploring mechanisms for delivering the scale using emerging online technologies to enhance viability and accessibility (Rausch & Zehetleitner, 2014; Shogren et al., 2017).

The purpose of the present study is to build on the pilot testing of the SDI-SR conducted by Shogren et al. (2017) and report on efforts to refine and validate the SDI-SR with a larger sample of youth with and without varying disability labels. The pilot study utilized a small sample and was focused on exploring the best subset of items from a large pool of items to utilize in further testing. For the present analyses, we generated a large standardization sample that was utilized to further test and refine the SDI-SR, validating its use across students with diverse disability labels and of varying races and ethnicities. We specifically analyzed data from large subsamples of specific disability groups (i.e., no disability, learning disability, intellectual disability, ASD, and other health impairments) and racial/ethnic groups (i.e., While, Black, Hispanic, Other) to allow for testing of cross-disability measurement invariance. The goal of the analyses was to further refine the number of items included on the assessment and identify the items that would be most discriminating between youth and young adults with and without various disability labels. The intended outcome was a validated set of items that could be utilized to assess self-determination in research and practice. As such, our primary research question was whether a robust set of items could be identified that showed measurement invariance across youth aged 13 to 22 years with varying disability labels (i.e., no disability, learning disability, intellectual disability, ASD, and other health impairments) of diverse racial/ethnic backgrounds (i.e., While, Black, Hispanic, Other).

Method

Sample and Setting

The overall validation sample for the SDI-SR included participants from urban, semiurban, and rural areas in 39 states, representing all regions of the United States. The sample consisted of 2,338 adolescents with and 2,352 without disabilities, and 51 who did not indicate disability status (included post imputation). Within the overall sample, represented disability groups included learning disability (n = 1,039, 21.9%), ASD (n = 230, 4.9%), intellectual disability (n = 299, 6.3%), other health impairment (n = 228, 4.8%), physical disability (n = 36, 0.8%), speech and language disability (n = 30, 0.6%), vision impairment (n = 36, 0.8%), hearing impairment (n = 17, 0.4%), traumatic brain injury (n = 4, 0.1%), and participants who indicated having two or more of the above disabilities (n = 333, 7.0%).

For the purposes of the present analysis, a reduced sample was used to include students from disability groups with the largest representation to allow for subgroup analysis. After multiple imputation of all missing data (both planned and unplanned), the sample analyzed included 1,796 adolescents with and 2,369 without disabilities (n = 17 inferred from imputation). Within the reduced sample, disability groups included learning disability, (n = 1,039, 24.9%), ASD (n = 230, 5.5%), intellectual disability (n = 299, 7.2%), and other health impairment (n = 228, 5.5%). Students with two or more disability labels were excluded from the analysis, as were adolescents with physical disability, speech language disability, vision and hearing impairments, and traumatic brain injury given the small sample sizes in these groups. Males outnumbered females in the disability group (n = 1,094, 60.9%; females = 702, 39.1%) while the gender representation within the group of adolescents without disabilities was approximately the same (females = 1,168, 49.3%; males = 1,201, 50.7%). The average age in the disability group was 16.6, which was similar to that of participants without disabilities (M = 16.4). The largest race/ethnicity category represented was White (n = 1,452, 34.9%), followed by Hispanic or Latino(a) (n = 1,119, 26.9%). Other race/ethnicities in the sample included Black (n = 1,057, 25.4%), Asian (n = 129, 3.1%), American Indian/Alaska Native (n = 106, 2.5%), and two or more races (n = 195, 4.7%). Notable differences between groups include that the majority of participants in the with disabilities group identified as White (n = 858, 47.8%), which was almost double participants who identified as White in the without disabilities group (n = 594, 25.1%). The largest represented race/ethnicity category in the without disability group was Black (n = 753, 31.8%), while only 16.9% of the with disabilities group identified as Black (n = 304). Table 2 provides additional demographic information broken down by disability group.

Measure

Self-Determination Inventory–Student Report. The measure of focus for the present study was the 51-item version of the SDI-SR that resulted from the pilot analyses of Shogren et al. (2017). This 51-item version of the SDI-SR was designed to be appropriate for self-report by youth with and without disabilities aged 13 to 22 years and overall self-determination, as defined by three essential characteristics (Volitional Action, Agentic Action, and Action-Control Beliefs) and seven component constructs of Self-Determined Action, shown in Table 1. Sample items for each component construct area also provided in Table 1. The version of the SDI-SR that students completed in this study included 45 items that asked adolescents to rate their level of agreement with the presented item (e.g., *I come up with ways to reach my goals*) using a continuous scale that presented the anchors at the end and asked the adolescent to indicate their agreement by marking on a line between the anchors (*Disagree* and *Agree*). Ratings made on the continuous scale were converted to scores ranging from 0 to 99. The remaining six items were means-ends problem-solving questions where adolescents are presented with the beginning and

Table 2. Demographic Characteristics of the Reduced Sample.

	With Disabilities (*n* = 1,796)		Without Disabilities (*n* = 2,369)		Total (*N* = 4,165)	
Characteristic	*n*	%	*n*	%	*n*	%
Disability						
No disability	—	—	2,369	100	2,369	56.9
Learning disability	1,039	57.9	—	—	1,039	24.9
ASD	230	12.8	—	—	230	5.5
Intellectual disability	229	12.8	—	—	229	5.5
Other health impairment	228	12.7	—	—	228	5.5
Gender						
Male	1,094	60.9	1,201	50.7	2,295	55.1
Female	702	39.1	1,168	49.3	1,870	44.9
Age						
13–14	379	21.1	547	23.1	926	22.2
15–16	558	31.1	795	33.6	1,353	32.5
17–18	471	26.2	603	25.5	1,074	25.8
19–20	260	14.5	269	11.4	529	12.7
21–22	124	6.9	181	7.6	305	7.3
M	16.6 (*SD* = 2.33)		16.4 (*SD* = 2.29)		16.5 (*SD* = 2.31)	
Race/ethnicity						
White	858	47.8	594	25.1	1,452	34.9
Hispanic or Latino(a)	420	23.4	699	29.5	1,119	26.9
Black	304	16.9	753	31.8	1,057	25.4
American Indian/Alaska Native	63	3.5	43	1.8	106	2.5
Asian	27	1.5	102	4.3	129	3.1
Two or more races	68	3.8	127	5.4	195	4.7
Native Hawaiian or Pacific Islander	9	0.5	9	0.4	18	0.4
Other	47	2.6	42	1.8	89	2.1

Note. ASD = autism spectrum disorder.

ending of a scenario and asked to rank three response options as the best, next best, and worst to complete the scenario. Adolescents could earn up to three points for correctly responding to the best, next best, and worst option. The means-ends problem-solving questions were associated with the component construct of Pathways Thinking and the essential characteristic of Agentic Action.

The SDI-SR was administered using a customized online platform using an open source relational database management system, MySQL. In building the online system, we identified key accessibility features that would promote engagement for all students, including those with disabilities (e.g., audio playback, in-text definitions of potentially challenging words, visual cues to indicate when items were responded to, completion progress bar). The customized online platform also allowed for the utilization of a slider scale, an innovative approach to reducing discrimination errors as discrete ratings are not required (Ahearn, 1997; Rausch & Zehetleitner, 2014), with ratings made on the slider scale converted to scores in the online system.

A paper-and-pencil version of the SDI-SR was created to align with the online version as closely as possible, with the ultimate plan of transitioning to a fully online assessment delivery system. To maintain congruence in ratings for the 45 items rated on a slider scale, we used a visual analog scale. However, the scoring between the online and paper-and-pencil versions of the scale varied. In the online system, computer programming was written to score from 0 to 99, while the lack of precision on paper and pencil required the use of an overlay to score on the visual scale from 0 to 20. The paper-and-pencil version was then rescaled to match the online version ([paper-and-pencil score / 20] × 99) prior to analyses. In addition, the format of the means-ends problem-solving questions in the paper-and-pencil version necessitated a deviation from the presentation used within the online platform and asked participants to match response options to best, next best, and worst labels. Ongoing work is examining the congruence between ratings on the online and paper-and-pencil version. However, initial data screening (e.g., exploration of differences in means and standard deviations across the two versions) suggested no substantial deviations in scores in the online and paper-and-pencil version.

Recruitment and Procedures

Human subjects approval was obtained from the university Institutional Review Board (IRB) prior to the study's implementation. Participant recruitment took multiple forms, including soliciting participation directly from school districts or higher education institutions (i.e., 4-year universities, community colleges) across the United States that had expressed interest in or support for the project. The research team also disseminated information through multiple professional communication channels (e.g., professional association newsletters, national and regional listservs, social media). When working with school districts and higher education institutions, the research team applied for approval to conduct research from the school district or university IRBs. After approval was received, the research team contacted principals and/or directors of special education in school districts and offices of accessibility and academic counseling on college campuses to determine participation in the study. In school districts, directors of special education put the research team directly in contact with special education teachers to facilitate completion in classroom settings with students with disabilities. To also target students without disabilities, the research team worked with the principal to select a subject that all general education students were enrolled in and required to take. In most participating high schools, English/Language Arts was a required subject for all general education students and no students took multiple English classes. At higher education institutions, the research team attended career fairs, where students typically completed the survey online at the time or took a flyer with the link for later completion, and also targeted entry-level courses for class-wide completion. To further enhance the sample, specifically the sample of older students and in certain disability groups, the research team contacted national, state, and community organizations seeking approval to distribute information about the study through internal email listservs where a link for young people to complete the survey online was provided. Because of the large scale and diverse recruitment methods (e.g., emailing distribution lists, relying on pushing out information about the project), the percentage of individuals approached who agreed to participate could not be calculated. Organizations that participated were provided with a certificate of appreciation, an aggregate report summarizing data collected, and information on evidence-based practices to promote self-determination as well as access to the overall study findings once completed and the final measure via self-determination.org.

When the assessment was completed in the school or college context, school personnel, based on conversations with the research team and depending on the availability of the technology in a particular setting, made a decision to use the online (n = 3,166; further described below) or paper-and-pencil (n = 999) version of the assessment. A multiform planned missing protocol was utilized (also described below). When schools chose to utilize the paper-and-pencil version, the research team chose the appropriate form per the planned missing data scheme described below based on the frequency of use of each version. The online version of the assessment automatically randomized the form that online participants were presented.

Adolescents were provided accommodations (e.g., reading questions, deciphering words) as needed by school personnel and the research team. For example, students with visual impairments were sometimes supported to answer an item using the slider scale by communicating their response on a tangible slider and then their response was recorded by school personnel on the online assessment. In addition, some participants that been provided with a link to the online assessment were mailed a paper-and-pencil version of the assessment.

Design

Because of the number of items required to be completed, given the additional measures completed by participants for ongoing research on the validity of the scale, items from the scales were administered using a multiform planned missing protocol (Little & Rhemtulla, 2013). A three-form planned missing design was used with surveys randomly administered wherein each form presented a select subset of items from the SDI scales. In addition to an X block of items answered by all participants (demographic items), all SDI items were split among variable sets A, B, and C to ensure that each SDI item would be paired with each other item on at least one of the three forms (i.e., XAB, XAC, or XBC). Because of the random assignment of person to form, the planned missing data are missing completely at random. Planned missing on the SDI items ranges from 24% to 31% depending on form (Form A = 26%, Form B = 29%, and Form C = 31%). This missing completely at random mechanism ensures no bias in any of the parameter estimates used to determine the adequacy of the items as indicators of the constructs. Advantages of the multiform approach include reduced burden on the participants, reduced assessment reactivity, and cost savings (Lang & Little, 2016; Little, Jorgensen, Lang, & Moore, 2014).

For unplanned missing data, we included the whole dataset to ensure that any potential Missing at Random (MAR) mechanism was represented. MAR occurs when missingness is predictable by other variables that are on the dataset. To do so, both planned and unplanned missing data were multiply imputed simultaneously using the R (R Core Team, 2017) package PcAux (Lang, Little, & PcAux Development Team, 2017). The PcAux package implements the ideas of Howard, Rhemtulla, and Little (2015) to create multiple imputations using principal components scores. This

package extracts auxiliary variables from the entire dataset to capture any potential MAR mechanism. We created 100 imputed datasets. "Not Applicable" values were coded as missing data before the imputation process and deterministically recoded in the multiply imputed datasets. All continuous and ordinal items were imputed using Predictive Mean Matching (PMM) and nominal items were imputed using multinomial logistic regression. All analyses were conducted using the information from all 100 imputed datasets.

Analyses

Missing data. Unplanned missing data were minimal (ranging from 1.1% to 6.5%). Before imputation, the raw data were augmented with two-way interactions between each variable and student gender, race/ethnicity, disability, and age. Any moderating effects of these variables were thereby retained in the multiply imputed datasets. The number of component scores used as predictors in the imputation models was defined in terms of the proportion of variance in the raw data explained by the selected set of component scores. For the current analysis, the multiple imputation was run using sets of component scores explaining 75% of the variance. Density plots were also evaluated to check the plausibility of the imputed values. The plots indicate that the imputation procedure was successful and did not produce any implausible replacements for the missing data.

CFA. A 20-group confirmatory factor analysis (CFA) using mean and covariance structures was conducted to evaluate the factor structure of the SDI-SR component constructs to inform decisions on scale reduction. Disability group and race/ethnicity were the target grouping variables in the present analysis (i.e., no disability, learning disability, intellectual disability, ASD, and other health impairment by four race/ethnicity groups: White, Black, Hispanic, and Other).

We evaluated measurement invariance to determine whether items were invariant in their structure (i.e., factor loadings and indicator intercepts are equal) between groups. Measurement invariance indicates that the items are measuring the same construct for each group with equivalent difficulty and discrimination. Mplus 7.2 (Muthén & Muthén, 1998/2017) with maximum likelihood (ML) estimation was used for all CFA analyses. The Effects Coding method of identification, in which factor loadings average to 1 and item intercepts average zero, was used for scale identification (Little, Slegers, & Card, 2006). We examined model fit using the comparative fit index (CFI $\geq$ .90), the Tucker–Lewis index (TLI)/nonnormed fit index (NNFI) $\geq$ .90, and the root mean square error of approximation (RMSEA) $\leq$ .08 (see Brown, 2015; Little, 2013).

Results

We conducted multiple group CFA item-level analyses of the constructs across the different disability groups (i.e., no disability, learning disability, intellectual disability, ASD, and other health impairments). Preliminary analyses revealed that the means-ends problem-solving items did not have adequate psychometric characteristics (i.e., they had limited variability of scores across groups, low correlations with other items, and low factor loadings in the initial model) to be included in any subsequent analyses. All other items were initially included in the item-level analyses.

The initial model that included all 42 items (six per subdomain) fit poorly because we ignored modifications for correlated residuals within each facet (i.e., component construct). We did this intentionally, given that we would be removing most of the offending items after item reduction; that is, any items with pronounced correlated residuals would be considered redundant and one or more of the items with the correlated residual were removed after careful theoretical consideration was given to the nature and meaning of the redundant items. With continuous data, an item is discriminating at all levels of the construct's factor scores, so the loading is a valuable piece of information. For each of the seven component construct, we retained three items that that were among the most discriminating (i.e., had the highest factor loading), had an item level mean that was roughly equivalent to the scale mean, and did not indicate dual loadings or a correlated residual with any of the items that were retained. In addition, items were required to meet theoretical criteria of being representative of the construct; we focused on ensuring representation of each component construct in Table 1. We used a balance of theory and data to winnow the number of items down to 21, with three items per component construct (i.e., Autonomy, Self-Initiation, Pathways Thinking, Self-Direction, Control-Expectancy, Psychological Empowerment, and Self-Realization).

We then examined configural, loading (weak), and item intercept (strong) invariance of the 21 items, organized into the seven component constructs and the three essential characteristics. We used effects coded method of scaling and allowed a few correlated residuals within a given domain when indicated by moderate modification indices (>20). Model fit information for each step of invariance testing is reported in Table 3. Change in model fit from configural to weak, where factor loadings were equated across groups, met invariance (ΔCFI < .01; see Cheung & Rensvold, 2002; Little, 2013). Equality of the indicator intercepts (strong invariance) across groups was also supported (ΔCFI < .01; see Table 3). Model fit was acceptable for a 20-group model with strong invariance constraints, χ^2(n = 4165, 4339) = 11753.87, CFI = .914, TLI = .917, standardized root mean square residual (SRMR) = .056, RMSEA = .091 [.089, .093]. The contribution to the chi-square value was uniformly

Table 3. Fit Indices for Nested Sequence in the Multiple Group Confirmatory Factor Analysis for the 21 Items.

Model	χ^2	*df*	*p*	RMSEA	RMSEA 90% CI	TLI	CFI	Constraint Tenable
Configural Invariance	10,660.59	3,651	<.001	.096	[.094, .098]	.907	.919	—
Loading Invariance	10,994.17	3,993	<.001	.092	[.090, .094]	.915	.919	Yes
Intercept Invariance	11,737.60	4,335	<.001	.091	[.089, .093]	.917	.914	Yes

Note. RMSEA = root mean square error of approximation; CI = confidence interval; TLI = Tucker Lewis Index; CFI = comparative fit index.

Table 4. Fit Indices for the Nested Sequence in the Multiple Group Confirmatory Factor Analysis for the Parceled Model.

Model	χ^2	*df*	*p*	RMSEA	RMSEA 90% CI	TLI	CFI	Constraint Tenable
Configural Invariance	653.08	220	<.001	.097	[.089, .106]	0.976	0.987	—
Loading Invariance	737.478	296	<.001	.085	[.077, .092]	0.982	0.987	Yes
Intercept Invariance	940.13	372	<.001	.086	[.079, .092]	0.981	0.983	Yes

Note. RMSEA = root mean square error of approximation; CI = confidence interval; TLI = Tucker Lewis Index; CFI = comparative fit index.

around 500 (450–594) for each disability group with the exception of the group of African American youth with ASD (755) and the group of White youth with learning disabilities (752) and around 800 for the dominant nondisability groups (746–927). Note that the correlations, means, and standard deviations among these 21 items are presented in Supplemental Materials, found at https://www.statscamp.org/self-determination-inventory-student-report.

Finally, we conducted parcel level analysis with seven facet-representative parcels (see Little Cunningham, Shahar, & Widaman, 2002; Little, Rhemtulla, Gibson, & Schoemann, 2013) representing each of the seven component constructs. We reevaluated model fit and measurement invariance across the 20 groups. The final model fit the data quite well, $\chi^2(n = 4165, 372) = 940.13$, CFI = .983; TLI = .981; RMSEA = .086 [.079, .092], and, again, measurement invariance held across all twenty groups (see Table 4). The final items can be found at www.self-determination.org.

Discussion

The purpose of this study was to establish the most robust set of items for the SDI-SR, a newly developed assessment of self-determination, its essential characteristics, and component constructs (see Table 1, Shogren, Wehmeyer, Palmer, Forber-Pratt, et al., 2015). This scale represents a significant advance in assessment of self-determination, as new assessment development activities have not previously been undertaken that are aligned with Causal Agency Theory, an up-to-date theoretical framework that describes the development of self-determination in adolescents with and without disabilities (Shogren, Wehmeyer, Palmer, Forber-Pratt, et al., 2015). We were also interested in exploring measurement invariance of these items across youth aged 13 to 22 years with varying disability labels (i.e., no disability, learning disability, intellectual disability, ASD, and other health impairments) of diverse racial/ethnic backgrounds (i.e., While, Black, Hispanic, Other) to ensure the same scale could be used across diverse groups.

Using the analytic procedures described in the Method, we identified 21 robust items that demonstrated good model fit (three per component construct of self-determination, see Table 1). Consistent with issues identified in pilot testing (Shogren et al., 2017), we did not retain means-ends problem-solving items after initial screening. These items were rated in a different format and did not show variability across respondents or correlate well with other items. Other items associated with Agentic Action and Pathways Thinking that were more robust were included in the final 21 items. Further research is needed to determine whether there are effective ways to deliver means-ends problem-solving questions in an online format. Traditionally, such questions have been open-ended and hand scored, which is not feasible in an online delivery system focused on providing immediate feedback. Furthermore, limited research has explored ways to develop means-ends items that are effective for and differentiate between problem-solving skills in adolescents with and without disabilities.

We were able to establish measurement invariance for both the overall model with 21 indicators, as well as with a parceled model using facet-representative parcels for the seven component constructs, suggesting the same set of items can be used across youth aged 13 to 22 years with varying disability labels (i.e., no disability, learning disability, intellectual disability, ASD, and other health impairments) of diverse racial/ethnic backgrounds (i.e., While, Black, Hispanic, Other). This is consistent with previous research on earlier tools developed to assess self-determination (Shogren, Kennedy, Dowsett, Garnier Villarreal, & Little, 2014) and suggests that in research and practice, the SDI-SR can be used to meaningfully assess self-determination as defined by Causal Agency Theory (Shogren, Wehmeyer, Palmer, Forber-Pratt, et al., 2015).

Limitations

In interpreting the finding from the present analysis, there are limitations that must be considered. First, there were sample-related limitations. We did not have adequate representation of all disability groups. We included four disability groups in the present analysis, in addition to the no disability group, that had a sufficient sample for standing alone in the analyses. Namely, students with learning disability, ASD, intellectual disability, and other health impairments. Further research will be needed with other disability groups to confirm the factor structure of the scale. Further research will also be needed to explore latent-level differences across the disability and racial/ethnic groups. Relatedly, the SDI-SR was designed to be a self-report measure, requiring that respondents be able to interact with the questions and ratings scales in an online or a paper-and-pencil format. Further work is needed to devise strategies to assess self-determination in students with more severe disabilities for who self-report measures are inaccessible. In addition, in the present study responses from the online and paper-and-pencil format were combined. Preliminary analyses suggested no substantial impact of response form, but future research is needed to further explore these findings. Furthermore, because of recruitment procedures, we were unable to calculate the percentage of respondents who agreed to participate, necessitating ongoing analyses of the representativeness of responses.

Similarly, we used a restricted set of racial/ethnic groups (White, Hispanic, Black, Other), and more research is needed on other racial/ethnicity groups that could not be used as subgroups in the present analysis. In addition, there were imbalances in the disability and no disability groups in the race/ethnicity representations. We noticed early in the analysis that race/ethnicity appeared to covary with disability status in item-level scores and chose to include this as a second grouping variable (in addition to disability group). Racial/ethnic differences in self-determination scale scores has been found in previous research within disability groups (Shogren, Kennedy, et al., 2014); however, our sample was not specifically structured to have balance across and within racial/ethnic and disability groups. Future research will be needed with larger and representative samples that account for varying degrees of representation of race/ethnicities within different disability groups. The present findings suggest the importance of addressing the intersection of these two factors and further considering both personal and environment factors that shape the development of self-determination.

Implications for Research and Practice

Overall, despite the limitations, the findings of the present analysis suggest that there are a core set of 21 items that can be meaningfully used on the SDI-SR to assess the essential characteristics and component constructs associated with self-determination as defined by Causal Agency Theory for adolescents with and without disabilities. The findings also suggest that we can meaningfully assess the self-determination of adolescents with and without disabilities in inclusive settings, providing guidance on instruction for all students on critical skills associated with career and college readiness and core content standards as skills associated with self-determination (e.g., initiation, planning, problem solving, goal setting, self-regulation) are embedded in college and career readiness and core content standard (Lombardi, Freeman, & Rifenbark, 2018; Lombardi et al., 2015; Morningstar, Lombardi, Fowler, & Test, 2017; Morningstar, Zagona, Uyanik, Xie, & Mahal, 2017; Shogren et al., 2016). The findings suggest that there is a critical need to consider issues related to personal factors that define one's culture, including disability and race/ethnicity in understanding self-determination and suggest that ongoing work is needed to examine interventions that embed features of cultural reciprocity and a flexible self-determination perspective (Leake & Boone, 2007; Shogren, 2011).

Embedding these considerations in research and practice is important, particularly as studies still frequently fail to report on race/ethnicity in participants (Hagiwara, Shogren, & Leko, 2017) and rarely explicitly consider these issues in the design and evaluation of interventions. In addition to race/ethnicity, there is a need for further research examining other personal factors, such as gender and age, as both factors have been shown in previous research to impact self-determination scores (Lee et al., 2012; Nota, Ferrari, Soresi, & Wehmeyer, 2007; Nota, Soresi, Ferrari, & Wehmeyer, 2011). Future research is also needed to specifically examine differences in scores on the SDI-SR across youth and young adults with and without disability labels, and developmental trajectories of both groups with and without exposure to interventions to promote self-determination. The purpose of the present analyses was to select the items that functioned most effectively across adolescents with and without disabilities, and the next step should be to further explicate the degree to which the SDI-SR detects differences across students with and without disabilities, as well as differences based on disability group.

In addition, there is a need to explore the sensitivity of the SDI-SR to environmental changes (e.g., the implementation of interventions to promote self-determination), as well as the longitudinal stability of scores on the SDI-SR over time. After establishing the factor structure and reliability of scores on a scale, ensuring that the scale is sensitive not only to variability in personal characteristics but also to environmental variability and changes that are implemented over time is necessary to justify the use of the measure to evaluate the efficacy and effectiveness of interventions to promote self-determination. There is also a need for ongoing research to explore the degree to which SDI-SR

scores differentiate from scores on associated assessments including previous assessments of self-determination. Such research will inform practice, specifically enabling the development of best practices to examine the longitudinal impacts in classroom context of interventions to promote self-determination.

There is also a need to further explore the degree to which there is correspondence between adolescent and parent and teacher's perceptions of the adolescent's self-determination. This is needed for all students, as well as for students for whom self-report measures such as the SDI-SR are not well suited to their personal characteristics. We developed the SDI-Parent Teacher Report (SDI-PTR; Shogren, Wehmeyer, et al., 2014) concurrently with the SDI-SR and it provides a parallel measure of self-determination from a parent or teacher's perspective. Research is needed with matched samples of adolescents, teachers, and parents to examine congruence in scores. This information can then be used to consider the impact of intervention on self-determination for multiple stakeholders and the impact of raising expectations and awareness of all parties with regard to self-determination–related capacities and opportunities. It also provides an opportunity to enhance the alignment of students, family members, and teacher's perceptions of assessment of self-determination. Ensuring that family members are a part of the transition planning team and that there is congruence across home and school in understanding and promoting self-determination is an area that needs ongoing research and implementation in practice (Zhang, 2005; Zhang & Benz, 2006). This has the potential to increase family–professional partnerships, particularly as youth move from school to the adult world.

Finally, as mentioned, we used a newly developed online system to deliver the SDI-SR to over half of our sample (see www.self-determination.org). The online system has been updated to reflect the 21 items identified as the most robust in these analyses. The online version provides additional supports for students that enabled more independent completion (e.g., text reader, in-text definitions) and reduced teacher burden for supporting the collection of assessment data. Furthermore, a new way of providing ratings, using a visual analog, slider scale, was introduced to reduce limitations of standard rating scales (Ahearn, 1997; Rausch & Zehetleitner, 2014). Ongoing research on the accessibility of such tools and the degree to which they enhance responding is needed, particularly for adolescents with disabilities, and including young people with more extensive support needs. And, the SDI-SR was designed to be responsive not only to research needs but also to the need, in practice, for teachers and others supporting adolescents to transition from school to adult life to have ways to assess and evaluate the impact of interventions to promote self-determination. Ongoing work is needed to develop the tools necessary to collect, organize, and analyze student, classroom, and school-level data on self-determination over time. Ensuring that the SDI-SR, its delivery, and its ability to provide meaningful access to data on outcomes for research, practitioners, and adolescents and family members will be a critical aspect of future research to translate self-determination assessment into practice.

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