Intellectual and Developmental Disabilities

Psychometric Properties of Self-Determination Inventory: Student Report among Chinese Students with and without IDD

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Abstract:	This study explores the psychometric properties of Self-Determination Inventory: Student Report (SDI:SR) in students with intellectual and developmental disabilities (IDD) and without disabilities in China. The paper-and-pencil version of SDI:SR Chinese Translation (SDI:SR Chinese) was used to explore self-determination across students with IDD (n=245) and students without disabilities (n=315) from 16 schools across six cities in China. We examined the factor structure of the measure, conducted analysis of measurement invariance, and compared the latent means across students with IDD and without disabilities. Findings suggest that the data fit a one-factor model better than a three-factor model. We found greater variability in self-determination among students with IDD than students without disabilities. However, the two groups did not differ in latent means.

Psychometric Properties of Self-Determination Inventory: Student Report among Chinese Students with and without Intellectual and Developmental Disabilities

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Conflict of Interest

The authors do not have any conflict of interest.

Abstract

This study explores the psychometric properties of *Self-Determination Inventory: Student Report* (SDI:SR) in students with intellectual and developmental disabilities (IDD) and without disabilities in China. The paper-and-pencil version of SDI:SR Chinese Translation (*SDI:SR Chinese*) was used to explore self-determination across students with IDD (*n*=245) and students without disabilities (*n*=315) from 16 schools across six cities in China. We examined the factor structure of the measure, conducted analysis of measurement invariance, and compared the latent means across students with IDD and without disabilities. Findings suggest that the data fit a one-factor model better than a three-factor model. We found greater variability in self-determination among students with IDD than students without disabilities. However, the two groups did not differ in latent means.

Keywords: self-determination, Chinese students, intellectual and developmental disabilities

Psychometric Properties of Self-Determination Inventory: Student Report among Chinese Students with and without Intellectual and Developmental Disabilities

Self-determination is an important outcome for people with intellectual and developmental disabilities (IDD). Nationally and internationally, there have been a number of studies linking self-determination to positive academic performance (Konrad et al., 2007; Ju et al., 2017), positive social and emotional outcomes (Carter et al., 2006), and positive post-school outcomes for adolescents with disabilities, including students with IDD (Chao et al., 2019; Shogren & Ward, 2018; Test et al., 2009). The self-determination construct has gained attention in disability research in the People's Republic of China (hereafter referred to as China). For example, the Professional Standards for Special Education Teachers in China requires teachers to incorporate self-esteem, self-confidence, self-reliance and self-strengthening into their daily instruction for students with disabilities (The Ministry of Education of the People's Republic of China, 2015). Further, researchers proposed promoting self-determination as a way to enhance inclusive services and post-school outcomes for students with disabilities, including students with IDD (Ding, 2019; Xu, 2016). These changes have resulted from the implementation of the National Special Education Promotion Plans (The Ministry of Education of the People's Republic of China, 2014; 2017), and the establishment of the National Curriculum Standards for Students with Special Needs in 2016 (The Ministry of Education of the People's Republic of China, 2016). Moreover, the advocacy movement initiated and led by families of children with disabilities has emphasized the importance of self-determination in education for students with disabilities. As such, self-determination has received increased attention in China in recent years.

Theoretical Models of Self-Determination

Since the early 1990s, several theoretical models of self-determination have been developed to serve as a foundation for educational practices. For example, the functional

model of self-determination was introduced in the 1990s and defined self-determination as a dispositional characteristic of an individual and defined by autonomy, self-regulation, psychological empowerment, and self-realization (Wehmeyer, 1999). Self-determination skills and abilities are assumed to develop over time as students learn and practice these skills and abilities across environments. The Arc's Self-Determination Scale was introduced to measure self-determination in accordance with the functional theory. Mithaug's (2003) self-determined learning theory is another theory commonly used in educational research, introduced in the U.S. in the 1990s According to this theory, learning is maximized when opportunities and adjustments are maximally favorable from/to the learners' point of view (Mithaug et al., 2003). Students learn to adjust their expectations when there is a discrepancy between their capacities (the person's assessment of their own skills and interests) and opportunities within the environments (Mithaug et al., 2003). The *American Institutes for Research (AIR) Self-Determination Scale* (Wolman et al., 1994) was developed based on self-determined learning theory and assesses self-determination capacity and opportunity.

Recently, Causal Agency Theory was introduced to build on previous self-determination theoretical frameworks and integrate other theoretical advances in the disability and positive psychology fields. It specifically integrates aspects of motivation and the importance of basic psychological need satisfaction from self-determination theory by Deci and Ryan (2000) as well as other advances in positive psychology and disability and education research (Shogren et al., 2015). Causal Agency Theory also integrates a stronger focus on how self-determination develops in all individuals, regardless of disability. Under Causal Agency Theory, self-determination is defined as "a dispositional characteristic manifested as acting as the causal agent in one's life" (Shogren et al., 2015, p. 258). According to this theory, self-determined actions have three essential characteristics; they are volitional, agentic, and driven by action control beliefs. *Volitional actions* are defined by

self-initiation and autonomy, referring to making intentional, conscious choices based on one's preferences and values (e.g., a student setting a goal to get a summer internship). *Agentic actions* refer to self-direction and pathways thinking, involving problem-solving processes needed to identify alternative pathways to navigate barriers in the goal attainment process. Using the example of a summer internship, this may involve the student taking actions and moving closer to the goal by getting a resume ready. Finally, *action-control beliefs* develop as people develop understandings of the association between their actions, the means employed, and the outcomes obtained (e.g., one believes that they have what it takes to get the internship based on the actions they are taking). The *Self-Determination Inventory: Student Report* (SDI:SR; Kansas University Center on Developmental Disabilities, 2019) was developed to align with Causal Agency Theory and has been validated in the United States with students with and without disabilities (Shogren et al., 2020), including students with IDD. Research shows the same set of items can be used across gender and disability groups (Shogren et al., 2018a; 2018b). Intervention studies have used the SDI:SR as an outcome measure and found that it is sensitive to changes in students' self-determination abilities before and after self-determination intervention (Shogren et al., 2019). The SDI:SR has also been translated into multiple other languages (e.g., American Sign Language, Spanish, French). Validation studies of the SDI:SR Spanish (Mumbardó-Adam et al., 2018) suggested cross cultural validity across American and Spanish youth with and without disabilities (Shogren et al., 2019) although also suggested the need to consider how to address context-specific supports and the role of the SDI:SR and Causal Agency Theory across cultural contexts.

Self-Determination Research in the Chinese Context

The term "self-determination" did not appear in the Chinese disability literature until 2005 (Bao & Zhang, 2005; Xu et al., 2020). Research since this time (Gao, 2016; Leng 2016;

Xu & Zhang, 2010; Zhang, 2017) has used a translated version of the *AIR Self-Determination Scale* (Wolman et al., 1994) with Chinese students with disabilities, focusing on adolescents with physical (Zhang, 2017) or sensory disabilities (Cheng & Sin, 2019). Additionally, a sample from Taiwan in China, researchers found that students with IDD, learning disabilities, and emotional disabilities scored lower on self-determination compared to their peers with vision, hearing, and health disabilities (Chao et al., 2019). They also found that level of self-determination was significantly correlated with more positive post-school outcomes (Chao et al., 2019). These findings suggest the importance of assessing self-determination during secondary school in secondary contexts.

However, more recent tools, such as the SDI:SR that is validated for students with and without disabilities and reflects ongoing knowledge developed since the AIR Scale was published in the 1990s, have not yet been translated. As such, there is a need to update current assessment practices in China. Having multiple self-determination assessments allows researchers and practitioners (e.g., special education teachers) to select a tool according to what they hope to understand about student self-determination and design and guide instruction to further develop self-determination. Further, having the opportunity to compare outcomes across students with and without disabilities is an area of need in the Chinese context as is ongoing work to advance cross-cultural understandings of self-determination. Translating tools like the SDI:SR can create opportunities to further explore the cultural relevance of self-determination. For example, Wang (2018) found that special education teachers and parents of children with disabilities in China often view self-determination as "make one's own choices/decisions," and called for a broader definition of self-determination in the Chinese context. Using the SDI:SR which has been translated into different languages can potentially advance allow cross-cultural or cross-national examinations of how cultural

factors (e.g., language, educational opportunities, cultural values) influence self-determination of students with and without disabilities, including students with IDD in China.

Purpose of the Present Study

Given the abovementioned background, the purpose of this study was twofold: to evaluate the psychometric properties of the Chinese translation of the SDI:SR and examine how Chinese students with and without IDD perceive their own self-determination abilities. This study addressed the following questions:

1. What is the factor structure of the *SDI:SR Chinese* in a Chinese sample?
2. Does measurement invariance of the *SDI:SR Chinese* hold across students with IDD and students without disabilities?
3. Are there differences in latent mean and variance scores across the groups?

We hypothesized, consistent with previous work with the SDI:SR (Shogren et al., 2018a; 2018b) and its translations (Shogren et al., 2019) that a single factor (i.e., overall self-determination) solution would best fit the data, that measurement invariance would be established across students with and without IDD, but that latent differences would be found with students with IDD experiencing more variability and lower overall self-determination.

Method

Participants and Settings

The research team intentionally contacted eight segregated special education schools and eight general education schools across six cities in Central-South, Southeast, and East of China based on ongoing collaborations. Although there is an emerging focus on inclusion, Chinese students with IDD are often still placed in special schools because these schools tend to have more special education resources than regular schools (Zhang, 2016). Gathering data with students across general and special schools provides a way to promote self-determination for all students and promote greater inclusion. The selected schools represent

different levels of school resources (e.g., financial support and teacher qualifications), in part due to the city's economic development level. Participants aged 12 to 22 were recruited from the 16 schools and 680 surveys were distributed. In total, 569 adolescents contributed some data, 254 were youth with IDD enrolled in segregated special education settings (37 also reported to have autism spectrum disorder) and 315 were students without disabilities enrolled in general education schools, with a response rate of 83.8%. Diagnostic classifications provided by the special schools were utilized in describing the sample of students with IDD (see Table 1), who followed accepted diagnostic and classification standards (Schalock et al., 2021; Schalock et al., 2019). Of these students, 560 contributed to the data analysis, nine students were missing data on all 21 items on the SDI:SR Chinese and were removed from analyses. Students that responded to one or more items were retained in the sample. See Table 1 for additional sample demographics.

Measures

Self-Determination Inventory: Student Report

The SDI:SR was originally developed in American English and is a self-report measure with 21 items that operationalize Casual Agency Theory. The SDI:SR is administered online and responses to each of the items are indicated on a slider (or visual analogue) scale with the anchors of disagree and agree. The online system converts ratings made by the end-user on the slider scale to scores ranging from 0 to 99 (Shogren et al., 2020). This online tool offers multiple accessibility features including in-text definitions and audio playback (see www.self-determination.org). As noted above, research has suggested the reliability and validity of the SDI:SR, the SDI:SR Spanish Translation, and the SDI:SR French Translation.

Self-Determination Inventory: Student Report (Chinese Translation)

The original SDI:SR was translated from English to Chinese following

recommendation from Fujishiro et al., (2010) as well the validated protocol for international translations from the developers of the SDI:SR (Kansas University Center on Developmental Disabilities, 2019) and adopted for other SDI:SR Translation. The first and second authors, who are proficient in English and Chinese and are researchers in special education and disability services, independently translated the original SDI:SR measure from English to Chinese. Following the initial translation, all discrepancies were discussed before consensus was reached. A survey with translated items was then created and subsequently sent to four graduate students from China majoring in special education in the U.S. to provide an alternative translation if they disagree with the translation. The authors then sent the revised version for backward translation. The consistency rate of the item meaning between the backward translated version and the original was higher than 90%. Consistent with protocols for translated versions of the SDI:SR, the translated version of the *SDI:SR Chinese* translation was administered via paper-and-pencil to determine the feasibility of use, prior to online programming consistent with the administration of the SDI:SR. As noted, the online SDI:SR uses a visual analogue scale (VAS), we mimicked this in the paper-and-pencil administration. Unlike a traditional Likert response scale which can be difficult for some people with IDD (Hartley & MacLean, 2006), VAS potentially provides greater accessibility to people with IDD by not requiring differentiation between response options and instead marking responses along a continuous line. Respondents were asked to indicate agreement by making a mark on a continuous line that was then scored by researchers from 0 (strongly disagree) to 20 (strongly agree). Responses were manually scored using a visual overlay on the continuous scale, again mimicking the scaling and online scoring of the SDI:SR.

Procedures

This study was endorsed and approved by the Office of Social Science Research and the School of Education's research committee at ***university name removed for blind-review.***

Prior to the commencement of the research, informed consent was obtained that emphasized the voluntary nature of participation and guaranteed all information would remain strictly confidential and be used for research purposes only. The first author reached out to eight principals to briefly explain the study purpose via telephone and mailed the information statement of the study, which included participants' inclusion criteria, participants' right, and research objectives. Next, the first author met with each principal and described in more detail the purpose of the study, inclusion criteria, and the voluntary nature of the study. Principals assisted in recruiting students who were willing to participate by distributing study information statement to parents for consent and students for assent before administrating the assessment. The scale was administered in classroom settings by research team members. The schedule and classroom settings were identified by principals and teachers across the special and general schools. Administration occurred either during a class session (e.g., group administration) or one-on-one, when more conducive to scheduling and supporting students. Consistent with administration protocols of SDI:SR (original American English version), the first author and two graduate research assistants introduced the scale, its purpose and the structure of the response system. The participants were provided with support as needed per administration guidelines, including facilitating access to information (i.e., reading the questions) and understanding the questions (i.e., giving synonyms, plain language and visual cues for challenging words). The recruitment process for students without disabilities and the scale administration procedures were identical across students with and without IDD, although students with IDD were more likely to request supports to promote access.

Data Analysis

Research Question 1. To answer the first research question, we estimated Cronbach's alpha to assess the internal consistency of *SDI:SR Chinese*. Next, we examined

descriptive statistics for each of the items for the overall sample, as well as by group (students with IDD and students without disabilities). Each of these preliminary analyses were conducted in R (R Core team, 2019) using the *psych* package (Revelle, 2018). To investigate construct validity, we estimated a series of confirmatory factor analysis (CFA; Bollen, 1989) models. We hypothesized a single factor (i.e., self-determination) solution would best fit the data, given research on the SDI:SR, however, we also fit a three factor model (i.e., volitional action, agentic action, and action-control beliefs – the three essential characteristics of self-determination) given this is the first test in the Chinese context. The CFA framework provides a means from which unobservable phenomenon or traits (e.g., self-determination) can be measured, due to its ability to partition observed variance for each item that is common among items (i.e., shared variance that represents the trait being measured) and variance that is unique to itself (i.e., measurement error). Therefore, upon fitting a CFA model inferences can be made with respect to self-determination in the population that are error free.

The measurement model parameters with respect to the variance structure include: the factor loadings (λ, unstandardized regression coefficients) which represents shared variance, manifest residuals (θ) which represents measurement error, and the latent variance (ψ) which represents the variability of the trait in the population and coincides with the estimated trait levels for the entire sample. The parameters that are estimated with respect to the mean structure are the manifest intercepts (τ) which represents the expected score for a given item when the latent variable is zero and the latent mean (α) which represents the population average for the trait being measured. In order for a unique solution to result, it is necessary to employ some form of identification which in turn provides scaling for the model parameters. We chose to employ the fixed factor method of identification, therefore, the latent mean was fixed to zero ($\alpha = 0$) which in turn allows for each manifest intercept (τ) to be estimated and

interpreted as the expected value for those with mean level self-determination; additionally, we fixed the latent variance to unity ($\psi = 1$) which allows each factor loading to be freely estimated.

To determine the adequacy of the models estimated, we consulted the χ^2 test of exact fit, as well as various approximate fit indices (AFIs): the root mean square error of approximation (RMSEA; Steiger & Lind, 1980) and the standardized root mean square residual (SRMR; Bentler, 1995) from the absolute perspective; as well as the comparative fit index (CFI; Bentler, 1990) and the Tucker-Lewis index (TLI; Tucker & Lewis, 1973) from the incremental perspective. Reasonable approximation is evidenced by CFI and TLI values of 0.95 or greater, RMSEA values of 0.06 or smaller; and SRMR values of 0.08 or smaller (Hu & Bentler, 1999). Aside from these global measures of fit, we also investigated sources of local misfit via modification indices and correlation residuals. Specifically, tests of exact and approximate fit are a function of the latent variable model's ability to reproduce the mean vector and variance-covariance matrix, therefore these tests rely on the difference between the observed and model-implied moments. As such, the standardized differences, interpreted as z-scores, result between the implied correlation matrix of observed variables and the model-implied correlation matrix, allowing us to diagnose local misfit (Bollen, 1989). Once we arrived at a final factor model, we proceeded to estimate omega hierarchical (ω; Zinbarg et al., 2006) which provides a robust estimate of construct reliability that takes into account all model parameter estimates.

Research Question 2. Using the final model resulting from Research Question 1, we estimated a series of multiple group CFA (MG-CFA; Sörbom, 1974) models to test for measurement invariance. MG-CFA provides a means for estimating a factor model simultaneously across heterogeneous groups (e.g., students with IDD and students without disabilities) which affords the opportunity to test for measurement invariance. Measurement

invariance is a desirable property as this means that the *SDI:SR Chinese* functions the same across groups and therefore, comparisons between populations can be made on the latent parameters (Research Question 3). The process of assessing measurement invariance entails fitting three models: form (or configural) invariance, metric (or weak) invariance, and scalar (or strong) invariance.

The form invariant model tests whether the factor structure (pattern of fixed and free parameters) is same across group and therefore, the identical identification approach is used for both groups. The metric invariant model tests whether the factor loadings can be constrained to be the same across groups and therefore, concerns the variance structure. The scalar invariant model tests whether the manifest intercepts can be constrained to be the same across groups and therefore, concerns the mean structure. Following recommendations from Cheung and Rensvold (2002), we utilized a change in CFI (ΔCFI) of 0.01 or less as evidence that the constraints in question are tenable and thus, establishing invariance. In order to make group comparisons on latent variances partial metric invariance must be established and for latent mean comparisons partial scalar invariance must be established (Byrne, Shavelson, & Muthén, 1989).

Research Question 3. To compare latent means and variances between groups (students with IDD and students without disabilities) we utilized MG-CFA. Due to the fixed factor method of identification being utilized, this was accomplished by constraining the latent mean and variance to zero and unity, respectively. We first compared latent variances, followed by a comparison of the latent means. To assess whether these model constraints were tenable we executed χ^2 difference tests with the scalar invariant model being the comparison model. A nonsignificant χ^2 difference test indicates the constraint is tenable and therefore, there is no difference between groups on the parameter in question (latent mean or variance).

All CFA and MG-CFA models were estimated in Mplus version 8.3 (Muthén & Muthén, 2019) using the robust maximum likelihood estimator. To inform our decision, we estimated Mardia's tests for multivariate skew and kurtosis using the psych package (Revelle, 2018). The response data was found to significantly deviate from multivariate normality; specifically, the estimate of Mardia's skew was 96.54 ($p < 0.001$) and Mardia's kurtosis was 802.14 ($p < 0.001$). With respect to missing data, after removing the ten cases without any response data across the 21 items, the maximum proportion of missing data was less than 1%, therefore, we elected to simultaneously recover missing data via full information maximum likelihood (FIML).

Results

We first examined descriptive statistics and internal consistency of the 21 items in *SDI:SR Chinese*. Reliability was found to be excellent, specifically, Cronbach's alpha was estimated to be 0.92 (95% C.I.: 0.92, 0.93). See Table 2 for all descriptive statistics (overall and by group).

Factor Structure of the *SDI:SR Chinese*

We initially fit the hypothesized three-factor model to the data, whereby volitional action, agentic action and action control beliefs were modeled with one another. This resulted in an out-of-bounds estimate for the latent correlation between agentic action and volitional action ($r = 1.006$, SE = 0.025), consistent with previous research. Aside from this improper parameter estimate the remaining estimated latent correlations were 0.95 or higher. Additionally, we fit a higher-order factor model with agentic action, volitional action, and action-control beliefs as lower order constructs of the higher-order construct self-determination; an improper solution resulted (i.e., the latent disturbance for agentic action was negative [-0.253]). Based on these findings, we concluded that the three-factor representation was not tenable. This finding is in concert with previous studies on the SDI:SR

(Raley et al., 2020; Shogren et al., 2020; Shogren et al., 2021). To this end, we fit a unidimensional model with the 21 translated SDI items.

Unidimensional Model. After subjecting the 21 items to a unidimensional factor structure we observed a significant χ^2 test of exact fit ($\chi^2_{df=189}$: 507.81, $p < 0.001$), however, the RMSEA and the SRMR were found to be acceptable with estimates of 0.055 (90% C.I.: 0.049, 0.061) and 0.05, respectively. On the other hand, the CFI and TLI did not reach acceptable levels with estimates of 0.89 and 0.88, respectively. Finally, upon investigating sources of local misfit via standardized differences between the observed and model-implied covariance matrices we identified an item ("I know my strength") as possessing many residuals that were z-scores of |1.96| or greater, respectively. Due to this, we re-estimated this model without this item as it had the largest standardized difference for a covariance observed with a z-score of 6.97.

Reduced Unidimensional Model. This reduced item set of 20 items resulted in a significant χ^2 test of exact fit ($\chi^2_{df=152}$: 421.32, $p < 0.001$), however, all fit indices indicated acceptable fit. Specifically, the RMSEA and SRMR were estimated to be 0.051 (90% C.I.: 0.045, 0.058) and 0.046, respectively; while the CFI and TLI were estimated to be 0.907 and 0.896, respectively. Upon investigating local misfit, we observed the item ("I chose what my room looks like") contained the most standardized covariance residuals that were greater than |1.96|, therefore, we removed this item and re-estimated the model.

Final Unidimensional Model. This reduced item set of 19 items resulted in a significant χ^2 test of exact fit ($\chi^2_{df=152}$: 377.14, $p < 0.001$), however, all fit indices indicated acceptable fit. Specifically, the RMSEA and SRMR were estimated to be 0.051 (90% C.I.: 0.045, 0.058) and 0.046, respectively; while the CFI and TLI were estimated to be 0.912 and 0.901, respectively. Using this final factor model, omega hierarchical (ω) was estimated to be 0.926. Table 3 shows the measurement model estimates derived from the CFA**.**

Measurement Invariance of the *SDI:SR Chinese*

Configural Invariance. The form invariant model was estimated whereby the same factor structure was simultaneously estimated in both groups while employing the same method of identification for both groups. This model was found to have acceptable fit with the RMSEA and SRMR estimated to be 0.058 (90% C.I.: 0.051, 0.065) and 0.055, respectively; and the CFI and TLI estimated to be 0.897 and 0.884. Due to the RMSEA and the SRMR being below 0.06, we concluded that configural invariance was established in spite of CFI and TLI below 0.95. Specifically, as the number of indicators per factor increases, the CFI and TLI indices tend to indicate worse model fit, while the RMSEA tends to indicate a better fit (Ding et al., 1995). See Table 4 for all model fit details for all measurement invariance details.

Metric Invariance. Next, we fit the metric invariant model to test the equality of the factor loadings across groups. Due to placing constraints on the factor loadings it was necessary to freely estimate the latent variance for the comparison group, resulting in a change of 18 degrees of freedom. We observed a ΔCFI of 0.01 and thus, established metric invariance.

Scalar Invariance. In a similar vein, we tested for the equality of manifest intercepts across groups in the scalar invariant model. To accomplish this, we constrained the manifest intercepts across groups and freely estimated the latent mean in the comparison group, therefore, we gained 18 degrees of freedom. We observed a ΔCFI of 0.037 and could not establish full scalar invariance. Through a systematic process we freely estimated manifest intercepts that were suspected to be noninvariant to determine the impact on model fit and were guided by the form invariant model which produces unique estimates for all parameters while utilizing the same method of identification. This exercise lead to freeing the manifest intercept for eight items. Of these freely estimated manifest intercepts, seven were in favor of students without disabilities, with the largest difference being observed for the item “I consider many possibilities when I make plans for my future”. The expected scores for this

item were 15.13 and 12.53 for students without disabilities and students with IDD, respectively. The sole exception of this pattern was item Q12 ("*I am confident in my abilities*") which was in favor of students with IDD, with the expected scores being 13.36 and 14.98 for students without disabilities and students with IDD, respectively. This reduced scalar model resulted in ΔCFI of 0.005 and thus, we established partial scalar invariance.

Due to establishing metric invariance and partial scalar invariance, we proceeded with group comparisons on the latent variance and mean, respectively. See Table 4 for all relevant model details for each of the measurement invariance models.

Latent Mean and Variance Scores across Groups

For the comparison between groups on the latent mean and variance, we used the partial scalar invariant model as this model was the most parsimonious model available between groups and served as the baseline model. The initial latent parameter to be compared across groups was the latent variance of self-determination. To accomplish this, we fixed the latent variance to 1.0 for the comparison group. This resulted in a significant χ^2 difference test ($\Delta\chi^2_{\Delta df=1}$: 59.0, $p < 0.001$) and therefore, this constraint was not tenable. In a similar manner, we compared groups with respect to their latent means by fixing the latent mean for the comparison group to 0.0. This resulted in a non-significant χ^2 difference test ($\Delta\chi^2_{\Delta df=1}$: 2.13, $p = 0.15$) and therefore, this constraint was tenable (i.e., students without disabilities and students with IDD do not differ with respect to the latent mean) and considered this the final model. Of interest students without disabilities and those with IDD share the same latent mean (0.0), however, the variability around this mean is far greater for those with IDD: 2.74 versus 1.00.

Discussion

The purpose of this study was to examine the preliminary reliability and validity of the *SDI:SR Chinese*. These analyses provide information on the potential utility of the

SDI:SR in the Chinese context, and highlight directions for future research examining how Chinese students with and without IDD perceive their own self-determination abilities. Overall findings suggest that, consistent with previous research (Raley et al., 2020; Shogren et al., 2017; Shogren et al., 2020) a one-factor, overall self-determination model, was better aligned with the data than a three-factor model. We also found that students with IDD in China showed greater variability in self-determination than students without disabilities. However, the two groups did not differ in latent means, which differs from research in other cultural contexts and was inconsistent with our hypothesis. Therefore, this study provides initial evidence for the *SDI:SR Chinese* from which we will build in future studies to generate robust scale scores on the *SDI:SR Chinese* that conform to Messick's unified framework of validity (Messick, 1995). Namely, we provide preliminary evidence of content, structural (research question 1), and generalizability (research questions 2 and 3) validities. In the following sections, we further discuss the key findings and implications.

Factor Structure

We found high correlations among the three essential characteristics defined by Causal Agency Theory in Chinese youth, as has been found in other studies (Raley et al., 2020; Shogren et al., 2020). Thus, a one-factor solution, representing overall self-determination fit the data best, consistent with our hypothesis. We found two items demonstrated misfit ("*I know my strength*"; "*I choose what my room looks like*"). It is possible that these two items may be perceived differently by students in China, and ongoing work is needed to further explore these findings. For example, in a society like China, where family and communal values are highly regarded, a focus on individual strengths may be de-emphasized and not discussed as frequently at school or home. As a result, the majority of the students may not have agreed with the item. Regarding the item about choosing how one's room looks, many Chinese students may not have considered decorating their room to be as

important as other things like academic performance (Xu, 2010), as frequently reported in Asian cultures (Zhang et al., 2010). Given these cultural differences, qualitative studies are needed to understand how students interpret these items and how that interpretation relates to self-determination and supports for it in the Chinese context. Additionally, ongoing work to collect and analyze more data with larger samples representative of students with a range of intellectual and developmental disabilities and support needs is needed to further examine the most suitable set of SDI:SR items to use in the Chinese context and enable cross-cultural comparisons. This is particularly true as the majority of our sample had a diagnosis of intellectual disability; however, we chose to include all students identified for participation to reflect the characteristics of students served in Chinese special schools. Further research that oversamples youth with other developmental disabilities (e.g., autism) is needed.

Measurement Invariance

While configural and metric invariance was established across students with and without IDD, we were not able to establish full scalar invariance. We found that eight manifest intercepts could not be constrained across groups. Therefore, the expected values for these items depends on the presence or absence of IDD. Four of these items are in the action-control beliefs domain, two in volitional action, and two in agentic action. In a previous study comparing self-determination in adolescents with and without intellectual disability in U.S. and Spain (Shogren et al., 2019), two of the four items in the action-control beliefs domain ("*I work hard to reach my goal*"; "*I am confident in my abilities*") also did not show equivalent intercepts between the two groups. As such, there may be differences in Chinese and other cultural contexts that lead to differing expectations and experiences across Chinese youth with and without IDD. One explanation is that in Chinese public schools where high-stakes tests are highly emphasized (Ding & Chen, 2019; Zhang, 2017), the word "goal" and "abilities" may have different implications to students with and without IDD. For students

without IDD, goals may be more related to grades. Yet, for students with IDD, goals may tend to emphasize functional skills, such as daily living skills, as this has been a focus in Chinese schools that provide segregated educational services (The Ministry of Education of the People's Republic of China, 2016). Ongoing work is needed to further explore these issues across students with and without IDD, particularly as there is a push for more inclusive educational opportunities in China. Additionally, as noted previously, ongoing work is needed within the IDD population in China to explore differences based on disability label and support needs, to inform supports for students with a range of characteristics and inform supports in inclusive settings.

Latent Differences

Although only partial scalar invariance was established, we proceeded to investigate latent differences as more than half of the manifest intercepts were found to be invariant across groups (Byrne et al., 1989; Shi et al., 2019). We observed that the latent variance in self-determination among students with IDD was twice as large as that observed for students without disabilities (2.74 vs. 1.00). A series of studies have reported great variability in self-determination among students with disabilities (Mumbardó-Adam et al., 2017; Shogren et al., 2017), likely because of the varying characteristics of students with disability labels, as well as the experiences of youth in their homes, schools and communities. Additionally, researchers have examined factors at the child (e.g., disability category, ethnicity), family (e.g., household income), and school level (e.g., educational setting) and found complex interactions between factors in explaining variability in self-determination outcomes (see Mumbardó-Adam et al., 2017). Future work is needed to explore personal and environmental factors that impact the expression of self-determination in the Chinese context, particularly how differing school environments and learning expectations shape educational opportunities for the development of self-determination across youth with and without IDD with a range of

support needs.

We did not find any group difference in latent mean between the two groups. One possibility is that students with IDD in this sample has less intense support needs due to the recruitment method. Before distributing the inventories to students with IDD, principals and classroom teachers from participating schools received sample items from the *SDI:SR Chinese* and might have decided certain students may not be able to complete the survey and thus have excluded those with significant support needs. Another possible explanation is related to response biases, such as acquiescence (i.e., the tendency to say yes or rate positive answers to questions regardless of content), which is more common for individuals with IDD compared to the general population (Emerson et al., 2013; Finlay & Lyons, 2001). This could have particularly been the case as the paper-and-pencil, preliminary version of the tool was used which does not provide access to the online, universally designed accessibility features that are in the fully functional version of the SDI:SR and SDI:SR Spanish. It is needed to investigate if these findings are replicated with larger samples with a range of support needs and disability labels. Researchers have suggested that the accessibility features that can be provided through online delivery impact responding, including greater variability and differentiation of responding (Raley et al., 2020).

Limitations

This study has several limitations that must be considered in interpreting the findings. First, we were not able to match students on relevant covariates in analysis, besides IDD status, as we did not have a large enough sample. Expanded samples, in future research, will enable greater examination of individual differences and key covariates in the Chinese context. We decided to include students with educational classifications of intellectual disability, reflecting the population of special schools in China to inform future research and practices in such contexts. However, the sample of students with IDD was primary comprised

of students with intellectual disability, necessitating future work with populations with related developmental disabilities as the findings may not generalize to students who do not disabilities other than an intellectual disability. Further, of our sample with students with IDD, some also reported to have autism spectrum disorder. However, we did not collect any diagnostic information of these students. Second, the study administered the paper-pencil version of the *SDI:SR Chinese*, which may have limited accessibility to students with IDD. However, testing the potential utility using a paper-and-pencil version was a necessary first step in the Chinese context, given the greater ease of administration in Chinese schools and the costs of programming the universal design features of the SDI:SR online. The paper-and-pencil version provided an opportunity to preliminary reliability and validity prior to engaging in more expensive online development activities. But, with the paper-and-pencil version, it was not possible to detect responses with increased precision as with the online visual analogue scale as scoring had to be conducted by researchers, limiting the precision of response scores, potentially introducing systematic error (Raley et al., 2020). However, it is important to note that initial data on the validity of the tool in the Chinese context was needed to justify the transition to an online version of the tool, and future research can build on this work to further examine differences in the Chinese context.

Implications for Research

We offer several future research directions. First, it is critical to understand how students in China perceive the items on SDI:SR, especially those items that had to be freed to establish partial measurement invariance. Cognitive interviewing or Delphi methods could be used to further understand the items and how they are interpreted by Chinese youth with and without IDD. Second, given the unique Chinese context, ongoing work may be needed to examine how self-determination is manifested for students with IDD. Preliminary evidence suggests that goals of students with disabilities in China can often be driven by the interests

of others rather than their own. For example, Ding (2019) interviewed ten students with IDD, seven parents, and eleven teachers and found that many participants report "not becoming a burden to the society" is a more important goal than pursuing a goal aligned with their own interests and strengths. Exploring how this influences self-determination, including in explaining differences across students with and without IDD is a critical direction for future research. Finally, quantitative studies involving a larger number of participants including students with IDD, particularly those that access inclusive environments, would be useful to explore whether inclusive opportunities explain some differences that were found in this study.

Implications for Practice

Researchers have consistently asserted that there are universal elements (etic properties) of the self-determination construct, however, the construct may manifest itself differently across cultural contexts (emic properties) (Ginevra et al., 2013; Hu & Palmer, 2012; Shogren, 2011). Thus, when assessing student self-determination, educators in China should take into consideration the unique role culture plays in the interpretations of items on the SDI:SR. The greater variability in self-determination in students with IDD suggests the importance of considering individual differences among students with IDD when working to support self-determination and choosing and evaluating the impact of interventions in the Chinese context. What has been learned in practice can inform ongoing research. Given that researchers in the U.S. have suggested the potential impact of promoting self-determination on access to the general education curriculum for students with disabilities (Lee et al., 2008), it is possible that a greater focus on both assessing self-determination and using interventions to promote it could lead to greater inclusive opportunities for students with IDD in China, consistent with policy goals. Tools such as the *SDI:SR Chinese* can be useful in evaluating these efforts, as ongoing information is gathered from teachers, students, and families on how

self-determination is understood and can be supported. Ongoing work is needed to align efforts to promote self-determination with the Chinese context and to individualize interventions to the needs of students, families, schools, and communities.

Conclusion

Researchers have consistently asserted that there are universal elements of the self-determination construct, but that self-determined actions may be expressed differently across cultures. This preliminary study represents an initial effort to understanding the expression of self-determination in Chinese students with and without IDD. Our findings provide preliminary evidence that the *SDI:SR Chinese* has relevance in the Chinese context, although differences in some items across these two groups warrant further research in the Chinese cultural context that has a long history influenced by the Confucian thoughts and the collectivism-orientated culture.

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Table 1

Sample demographics

Characteristic	Intellectual / Developmental Disability*		No Disability		Total	
	N = 254		N = 315		N = 569	
	n	%	*n*	%	*n*	%
Gender						
Male	148	62	156	50	249	45
Female	90	38	159	50	304	55
Age						
M (SD)	16.35(2.65)		15.08*(1.67)*		15.63 *(2.25)*	
Residence						
Living by oneself	2	1	10	3	12	2
With parents	204	84	277	97	481	91
Others	37	3	0	0	37	7
Level of intellectual and adaptive behavior impairment						
Mild	94	40	-	-	-	-
Moderate	120	51	-	-	-	-
Severe and profound	22	10	-	-	-	-
Employment						
Having a job	23	12	4	2	27	6
Not working	170	88	225	98	395	94
Level of Support						
No support needed	20	10	12	-	-	-
A little support needed	59	27	99	-	-	-
A lot of support needed	92	41	116	-	-	-
Support needed all the time	51	23	82	-	-	-

Note. *There were 37 students with IDD who also reported to have autism spectrum disorder.

Table 2

Descriptive Statistics - Overall and by Group for the SDI:SR Chinese

	Overall (n = 560)		No disability Group (n = 315)		Intellectual and Developmental Disability Group (n = 245)	
Item	mean	sd	mean	sd	mean	sd
Q1	14.04	4.78	14.16	3.84	13.88	5.77
Q2	13.19	4.80	13.29	3.90	13.07	5.77
Q3	13.85	5.21	15.13	3.61	12.19	6.36
Q4	13.84	5.22	13.75	4.79	13.97	5.73
Q5	14.88	4.84	14.84	4.74	14.94	4.97
Q6	14.92	4.67	15.45	3.85	14.24	5.49
Q7	14.77	5.20	15.81	4.18	13.43	6.03
Q8	15.23	4.45	15.60	3.82	14.76	5.11
Q9	15.08	4.70	15.15	4.39	14.98	5.09
Q10	15.76	4.12	16.34	3.22	15.01	4.95
Q11	14.23	4.48	14.52	3.33	13.86	5.61
Q12	13.89	4.86	13.37	4.30	14.56	5.44
Q13	13.67	5.16	14.12	4.07	13.09	6.24
Q14	13.50	5.05	13.88	4.01	13.02	6.11
Q15	14.12	5.21	14.68	4.58	13.41	5.86
Q16	15.66	4.52	16.46	3.58	14.62	5.33
Q17	13.85	4.59	13.58	3.92	14.20	5.32
Q18	14.06	5.69	14.56	5.18	13.42	6.23
Q19	14.34	4.85	14.81	3.88	13.74	5.83
Q20	13.96	5.35	14.11	4.98	13.76	5.79
Q21	13.73	5.06	14.07	4.13	13.29	6.02

Table 3

Measurement Model Estimate

Item	λ (Factor Loadings)		τ (Manifest Intercepts)	
	Estimate	SE	Estimate	SE
Q1	2.521	0.222	14.036	0.202
Q2	2.897	0.193	13.193	0.203
Q3	2.971	0.232	13.846	0.22
Q4	2.793	0.212	13.843	0.22
Q5	2.43	0.228	14.88	0.204
Q6	3.001	0.214	14.92	0.197
Q7	3.288	0.224	14.77	0.22
Q8	2.709	0.23	15.229	0.188
Q9	2.603	0.243	15.075	0.199
Q10	2.918	0.204	15.757	0.174
Q11	3.426	0.191	14.232	0.189
Q12	3.141	0.211	13.886	0.205
Q13	3.636	0.195	13.676	0.218
Q14	3.631	0.192	13.504	0.213
Q15	3.014	0.219	14.123	0.22
Q16	2.744	0.218	15.657	0.191
Q17	3.189	0.19	13.852	0.194
Q19	3.267	0.203	14.343	0.205
Q21	3.733	0.177	13.729	0.214

Note. $\Psi = 1.0$; $\alpha = 0.0$

Items 18 and 20 were removed to improve model fit.

Table 4

Measurement and Latent Invariance

Step	Model	χ2	df	Scaling Factor	BIC	RMSEA [90% C.I.]	CFI	TLI	SRMR	ΔCFI	Δχ2, Δdf, p
1.0	Form	589.325	304	1.561	59427.8	0.058 [0.051, 0.065]	0.897	0.884	0.055	-	-
2.0	Metric	635.059	322	1.534	59367.7	0.059 [0.052, 0.066]	0.887	0.88	0.071	-0.010	-
3.0	Scalar	755.379	340	1.505	59416.5	0.066 [0.060, 0.072]	0.85	0.849	0.084	-0.037	-
3.1	Partial Scalar	659.636	332	1.518	59331.5	0.059 [0.053, 0.066]	0.882	0.878	0.074	-0.005	-
4.0	Variance	699.910	333	1.516	59385.3	0.063 [0.056, 0.069]	0.868	0.864	0.182	-	59.002, 1, < 0.001
5.0	†Mean	661.702	333	1.516	59326.9	0.059 [0.053, 0.066]	0.882	0.878	0.074	-	2.128, 1, 0.145

Note. † = final model; Δχ2, Δdf, p = χ2 difference test