Self-Determination Assessment in Adults with and without Intellectual Disability

Karrie A. Shogren

Graham G. Rifenbark

Mayumi Hagiwara

University of Kansas

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Abstract

This paper analyzes the reliability and factor structure of the Self-Determination Inventory: Adult Report (SDI:AR) in adults with and without intellectual disability. There is a critical need for contemporary assessment tools given the emphasis on self-determination outcomes in disability supports and services. The findings suggest that with the same set of items can be used across adults with and without intellectual disability. However, there are significant differences in overall self-determination across adults with and without intellectual disability, with adults with intellectual disability scoring lower on the SDI:AR. Implications for research and practice are discussed.

Self-determination has received significant attention as a valued outcome in the context of disability supports and services (Centers for Medicare and Medicaid Services, 2014; Shogren, Abery, et al., 2015; United Nations, 2006). Ensuring that people with disabilities, particularly adults with intellectual and developmental disabilities, have the supports necessary to be self-determining is a key goal of disability policy (Shogren, Luckasson, & Schalock, 2015). Multiple research studies have documented the benefits of enhanced self-determination for adults with disabilities as well established the feasibility and effectiveness of supports that enhance self-determination for adults with intellectual and developmental disabilities (Dean, Burke, Shogren, & Wehmeyer, 2017; Shogren et al., 2016).

Critical to examining self-determination outcomes in adults with intellectual disability is having tools that have been demonstrated to measure self-determination status in a valid and reliable manner. These tools should also possess sufficient sensitivity to detect variations in outcomes that may occur as a function of changes in supports and services. Given the importance placed on self-determination, items related to self-determination (e.g., opportunities for choice and control in one's life) are routinely embedded in major outcome evaluation tools and frameworks in the intellectual and developmental disability field, such as the National Core Indicators (NCI; Bradley, 2017). Gathering indicators of aspects of self-determination through the NCI and other evaluation frameworks is useful for understanding the impact of supports and services on specific opportunities related to self-determination, However, there is also a need to have tools that measure self-determination globally and are aligned with theoretical conceptualizations of self-determination and its development throughout the life course. There is an adult version of *The Arc's Self-Determination Scale* (Wehmeyer, 1996), that has been used in research to examine global self-determination; however, the tool has not been updated with

emerging research and theory in self-determination, it has a substantial administrative burden given its length and complexity (72 items), and it has not been validated with adults with and without disabilities to allow comparative work and documentation of disparities.

Because of the need for contemporary, valid measures of overall self-determination, the Self-Determination Inventory System (Shogren & Wehmeyer, 2017) was developed. The Self-Determination Inventory System was developed to align with Causal Agency Theory (Shogren, Wehmeyer, et al., 2015), a recently introduced theoretical reconceptualization of self-determination and its development across the life course. 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, et al., 2015, p. 258).

Causal Agency Theory builds on previous frameworks that have shaped assessment and intervention development in the disability field, including the functional model of self-determination (Wehmeyer, 1992) that led to *The Arc's Self-Determination Scale*. Causal Agency Theory, however, focuses on integrating emerging research from the fields of disability, education and psychology, particularly research on social-ecological approaches to disability (Schalock et al., 2010; Shogren, 2013), strengths-based assessment and intervention (Lopez & Snyder, 2011), the role of environments that facilitate autonomy, competence, and relatedness (Deci & Ryan, 2012; Niemiec & Ryan, 2009), and the significant growth in research on how to support the development of self-determination abilities (Burke et al., in press; Hagiwara, Shogren, & Leko, 2017).

Causal Agency Theory describes three essential characteristics of self-determined, goal direction 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, acting flexibly to navigate 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 outcomes. People with adaptive action-control beliefs act with positive control-expectancies, with self-realization, in a psychologically-empowered way (Shogren, Wehmeyer, et al., 2015).

As a dispositional characteristic, it is assumed that the essential characteristics of self-determination develop throughout the life course, including into adulthood, and are shaped by contextual factors, such as available opportunities and supports, that enable self-determination. As such, self-determination can be meaningfully measured, and changes documented throughout development as supports and contextual factors change.

The Self-Determination Inventory System was designed to align with Causal Agency Theory and measure overall self-determination and its three essential characteristics. It includes a Student Report version (SDI:SR for adolescents aged 13-22), a Parent/Teacher Report version (SDI:PTR, validated for parent and teacher proxy-report for adolescents aged 13-22 that has not yet been tested for adult proxy-respondents) and an Adult Report version (SDI:AR; ages 18 and over). Initial research was conducted on the SDI:SR, establishing the best set of 21 items to measure self-determination aligned with Causal Agency Theory in adolescents with and without disabilities (Shogren, Little, et al., in press), and the feasibility and importance of providing online, universally designed supports to assess self-determination in adolescents with disabilities

(Raley, Shogren, Rifenbark, Anderson, & Shaw, in press). Researchers established that the same set of SDI:SR items could be used across adolescents with no disability, learning disability, intellectual disability, autism spectrum disorders, and other health impairments, but that overall differences in scores were detected (as predicted) based on disability, age, race/ethnicity, and other contextual factors (Shogren, Shaw, Raley, & Wehmeyer, 2018a, 2018b) establishing the discriminant validity of the scale. Further, the concurrent validity of the SDI:SR has been explored by exploring the relationship between scores on the SDI:SR and related assessments of hope, motivation, and action-control beliefs, identifying the unique contributions of the self-determination construct (Shogren, Shaw, & Raley, in press). Research has also examined similarities and differences in scores on the SDI:SR and the SDI:PTR, suggesting differences in scores when comparing self- and proxy-responses (Shogren, Anderson, Raley, & Hagiwara, in press).

Increasingly, the SDI:SR is being adopted in research examining the impact of self-determination interventions in adolescents with intellectual disability (Shogren, Burke, et al., 2018; Shogren, Hicks, et al., in press) and an online data dashboard system has been created and adopted by researchers and schools/disability support organizations that allows for immediate reporting of scores to end users and aggregation and management of scores over time by projects and organizations. As such, researchers have increasingly suggested the feasibility and utility of online, universally designed assessment of self-determination; however, this work has focused on adolescents (Raley et al., in press; Shogren, Little, et al., in press). There remains a need to ensure that self-determination assessment is available for adults with and without disabilities, particularly adults with intellectual disability, given the centrality of this outcome in disability supports and services and the lack of current measures of overall self-determination for research

and practice. As such, the purpose of this paper is to describe the results of an examination of the reliability and factor structure of SDI:AR items (based on the SDI:SR; discussed subsequently). We examined the degree to which the same set of items can be used across adults with and without intellectual disability and the presence of differences in overall scores. Specifically, the following research questions are addressed:

1. What is the factor structure of the Self-Determination Inventory: Adult Report?
2. Does the Self-Determination Inventory: Adult Report function the same for adults with and without intellectual disability?
3. Are there latent differences in self-determination scores across adults with and without intellectual disability?

Method

Self-Determination Inventory: Adult Report

The SDI:AR was developed to provide a self-report measure of self-determination that could be used across disability populations, including those without disabilities, aged 18 and over. It builds on work conducted with the SDI:SR, described previously. To generate items for the SDI:SR, an extensive review of the literature and existing self-determination and related assessments was undertaken to develop potential items. From an initial set of over a hundred items, the items were winnowed through a combination of expert review, stakeholder feedback, and pilot testing of a subset of possible items (Shogren, Little, et al., in press; Shogren et al., 2017). The final items of 21 items were selected to measure the three essential characteristics of self-determination (volitional action, agentic action, action-control beliefs) that contribute to the overall self-determination construct in Causal Agency Theory (Shogren, Wehmeyer, et al., 2015). They were also selected to be applicable across contexts (e.g., not linked to specific

actions at home, school or in the community), and potentially to be applicable across development, including into adulthood to enable comparative work across a range of ages. After items were established for the SDI:SR, focus groups were conducted with self-advocates with intellectual disability to ensure that the items had relevancy for the SDI:AR.

Our next step, which is described in the present analyses, was to examine the functioning of the 21 items in adults with disabilities. Specifically, we were interested in examining item applicability and factor structure across those with and without intellectual disability, given the importance of self-determination assessment in this population. As such, the SDI:AR that was utilized in the present analyses contains the same 21 items as the SDI:SR. Changes were made to demographic items that are programmed into the online system at the end of the assessment to capture more information relevant to adult roles and responsibilities, including living arrangement and employment status; however, the assessment itself including items and rating scales remained the same.

Responses to the SDI are collected via a customized online platform (www.self-determination.org) that incorporates features of universal design (e.g., items can be read aloud, definitions appear for challenging words, visual supports for navigation are provided). The average reading level of items is 2.8, which was determined using standard online readability assessment tools, and responses to items are provided on a slider scale whereby respondents identify the degree to which they disagree or agree with a given statement. Respondents simply click on continuous line on the screen, which represents a continuum from disagree to agree and then the computer generates a score between 0 and 99. Respondents do not see these numbers, and therefore do not have to make distinctions between numbers or discrete response options (e.g., strongly disagree or somewhat disagree as is the case with Likert scales). Researchers have

found that using slider scales can reduce discrimination errors as discrete ratings are not required (Ahearn, 1997; Rausch & Zehetleitner, 2014), although more work is needed specifically with adults with intellectual disability. However, research has suggested that the lack of demand for distinguishing between options and presentation of the continuous scale and can promote accessibility and variability in responding for people with intellectual and other disabilities (Raley et al., in press). After completion of the scale, all survey takers received an individualized report with scores for overall self-determination and its three essential characteristics, and item-level responses are maintained in the system for analysis.

Participants and Procedures

Upon receiving Institutional Review Board approval, adults with and without intellectual disability were recruited to complete the SDI:AR through (a) direct email invitations to postsecondary education institutions, disability-related agencies, and self-advocacy groups in rural, suburban and urban areas across the United States, and (b) sharing recruitment information through local, state, and national organizations' email listservs and social media accounts. Every participant who completed the survey online received a $5 gift card for their participation. In most cases, supporters of adults with intellectual disability (e.g., family members, support providers, postsecondary education professionals, coordinators of self-advocacy groups) received the recruitment information, and they structured opportunities and provided supports for the adults to complete the SDI:AR in their settings; however, the research team had limited direct information on how administration occurred. Additionally, the third author visited multiple disability-related agencies and self-advocacy group meetings and conferences directly with digital devices to create opportunities and to support adults with intellectual disability to complete the SDI:AR if they did not have access through other recruitment mechanisms. The

initial goal of recruitment was to generate a sample that would represent adults ages 18 and over with intellectual disability, although this was expanded to include other disability labels given the interest in participation (e.g., autism spectrum disorder, physical disabilities). Details about the study and consent procedures and data use were provided in the online system, and if an adult indicated they had a guardian (n = 33), permission to take the survey was requested from the guardian before the adult took the SDI:AR. Further, we were able to recruit a number of adults without disabilities to complete the survey, although these adults were often connected to participants with disabilities, including family members and professionals. It is important to note, however, that we did not independently verify disability status of any participants, relying on what was reported in the online system as part of the demographic items.

The present analysis focuses on the data collected from adults with intellectual disability (n = 115) as well as those without disabilities (n = 118). Ongoing work is being undertaken to collect additional data to enable analysis of other sub-populations, including those with autism spectrum disorder, physical disabilities, and mental health disabilities. Of the 233 adults with and without intellectual disability who contributed to this analysis, they ranged in age from 18 and 71 years old, a slight majority (56.6%) were female, and a majority worked at least part time, although these numbers varied based on the presence or absence of a disability. A slight majority of adults with intellectual disability reported living with their family, consistent with national data (Larson et al., 2018) Further, there were noticeable discrepancies in the highest level of education that an adult has completed and the level of support a person needed in life across those with intellectual disability and without disabilities. Specifically, we asked all participants to rate the level of support they needed on a single item, ranging from “no support needed” to “support needed all the time.” More adults with intellectual disability indicated they

needed a lot or a little support, than those without disabilities. Table 1 provides more complete demographic information, broken down by those with and without intellectual disability.

Data Analysis

To address the three research questions, a series of analyses were undertaken using a confirmatory factor analysis (CFA; Bollen, 1989) framework. The main assumption of our adoption of the CFA framework was that the individual's self-determination status is the cause of their responses to the SDI:AR items. As such, each item's observed variance was partitioned into variance that is common (i.e., the measured construct) and variance that is unique to the item (i.e., measurement error). This allows us to specifically test the degree to which items can efficiently discriminate between those with high and low levels of self-determination as determined by their factor loadings.

Goodness-of-fit. CFA models are judged based on their ability to reproduce the observed covariance matrix and means. Therefore, to test the adequacy of the CFA models, we consulted the chi-square test of exact fit and various approximate fit indices (AFIs). Specifically, we utilized the comparative fit index (CFI) and the Tucker-Lewis index (TLI) from the incremental perspective; and the root mean square error of approximation (RMSEA) and the standardized root mean square residual (SRMR) from the absolute perspective.

Local misfit. The aforementioned fit statistics and indices provide a means for evaluating global model fit, however, we also investigated local misfit by consulting modification indices (Bollen, 1989). Specifically, modification indices test the expected reduction in chi-square if a path is freely estimated. Additionally, we consulted a residual covariance matrix (Bollen, 1989). Given that model fit for CFA models is a function of the difference between the model-implied and observed covariance matrices among items, we used this residual covariance matrix to

identify problematic items. To guide our decision, we consulted a standardized residual covariance matrix (i.e., differences are represented as z-scores) to aid us in understanding which residuals were significantly impacting model fit. Specifically, an absolute value of 1.96 (or |1.96|) or greater indicates a viable source of local misfit.

Scaling and identification. To ensure a given solution in the CFA framework is unique, it is necessary to employ some form of model identification. Additionally, identification of the CFA model provides scaling for the model's parameters. To this end, we utilized the fixed factor approach to identification and thus, scaled the parameters with respect to the latent variable. Specifically, the latent mean is fixed to 0.0 and the latent variance is fixed to 1.0. By employing the fixed factor approach, indicator reliability can easily be estimated via tracing rules and is interpreted as the proportion of variance explained by the latent variable.

The aim of Research Question 1 was to determine the dimensionality of the SDI:AR. After arriving at the optimal measurement model, we explore the functioning of the SDI:AR items across adults with and without intellectual disability to address Research Question 2. Finally, if appropriate, to address Research Question 3, we investigated group comparisons on the latent parameters (e.g., mean and variance). The methods for these analyses are detailed below. All latent variable analyses were run in Mplus version 8.3 (Muthén & Muthén, 1998-2019).

Prior to estimating latent variable models for Research Questions 1 through 3, we carried out an item analysis of the SDI:AR items which included descriptive statistics (e.g., mean and standard deviation) and their internal consistency via Cronbach's alpha. These analyses were conducted in the R environment (R Core Team, 2019) using the psych package (Revelle, 2018). Additionally, we assessed multivariate skew and kurtosis of the SDI:AR data by estimating

Mardia's test statistic using the MVN package (Korkmaz, Goksuluk, & Zararsiz, 2014) in the R environment.

Research Question 1. Our first step was to test a CFA model informed by the hypothesized structure for the items (i.e., Causal Agency Theory). Recent studies on the SDI:SR have suggested that self-determination is best captured using a single-factor model (Raley et al., in press), however, the dimensionality (i.e., the degree to which agentic action, volitional action, and action-control beliefs are separate constructs) of the SDI:AR has yet to be examined. In order for a CFA model to be determined to be feasible, acceptable data-model fit must be established and its parameter estimates must be reasonable (i.e., negative variances, or Heywood cases). As such, our initial model was a three-factor model. Of interest were the estimated latent correlations among the hypothesized constructs to determine the degree to which the constructs overlapped with one another. Additionally, we assessed its feasibility using global fit indices and investigated sources of local misfit and consulted modification indices (e.g., correlated residuals and cross loadings). Next, we tested a single-factor model to serve as a comparison model and judged it in the same fashion. Finally, we estimated omega hierarchical which is a conservative measure of construct reliability as it is utilizes the observed variance-covariance matrix rather than the model-implied covariance matrix (McDonald, 1999).

Research Question 2. After establishing the optimal factor structure for the SDI:AR in Research Question 1, we employed a series of multiple group confirmatory factor analysis models (MG-CFA; Sörbom, 1974) to determine whether the set of SDI:AR items function the same for those with and without intellectual disability. In a sequential manner, a series of models were estimated to test measurement invariance: form or configural invariance (i.e., pattern), metric or weak invariance (i.e., factor loadings), and scalar or strong invariance (i.e., manifest

intercepts). Judgement regarding whether measurement invariance held across groups was made using the criteria put forth by Cheung and Rensvold (2002). Specifically, if the change in CFI (ΔCFI) is 0.01 or less the constraint was determined to be tenable (e.g., moving from the form invariant to the metric invariant model). By establishing form invariance, we confirm that the factor structure established in Research Question 1 is the same for the two populations (with and without intellectual disability). After establishing metric invariance, we recognize that the factor loadings are equivalent across groups and therefore, group comparisons can be made on the latent variance (Research Question 3). In a similar vein, by passing scalar invariance we recognize that the expected score for the manifest intercepts are the same across groups and as a result, group comparisons can be made on the latent mean (also Research Question 3). At a minimum partial metric and scalar invariance must be established in order for latent variances and means to be compared across groups (Byrne, Shavelson, & Muthén, 1989).

Research Question 3. To test for latent parameter invariance we conducted chi-square difference tests ($\Delta\chi^2$). When evaluating whether groups differed with respect to the latent variance, we fixed the latent variance for the group with intellectual disability to 1.0 to match the group without intellectual disability, from this action a single degree of freedom is gained. In a similar vein, the group comparison is made by constraining the latent mean for the group with intellectual disability to 0.0. The comparison model for each of these tests is the final model arrived at from Research Question 2. A non-significant chi-square test indicates the constraint under question is tenable (i.e., groups do not differ).

Results

After subjecting the 21 SDI:AR items to a descriptive analysis we found a general trend for the means and standard deviations across all items. Specifically, the estimated means were

always greater for the group without intellectual disability and the standard deviations for this group were always smaller than those with intellectual disability. In terms of missing data, we observed minimal proportions of missing data for the entire sample, ranging from 3% to 8% across each SDI:AR item. We found that three observations in the intellectual disability group were missing on all 21 items and therefore, were not included in the latent variable models generating an overall sample size of 230, with 112 participants represented in intellectual disability group. Due to the limited amount of missing data we utilized full information likelihood which is a model-based approach to missing data estimation and is unbiased when the missingness is either missing completely at random or missing at random (Enders, 2010), which we believed to be the case. See Table 2 for descriptive statistics for the overall sample, as well as by group. With respect to internal consistency we found high levels of reliability. Specifically, Cronbach's alpha was estimated to be 0.96 [95% C.I.: 0.96, 0.97] for the overall sample, 0.97 [95% C.I.: 0.96, 0.98] for those with intellectual disability, and 0.93 [95% C.I.: 0.93, 0.96] for those without intellectual disability. This information can also be found in Table 2.

In terms of multivariate normality for the sample, the estimated Mardia's test statistic for skew was 11299.07 ($p < 0.001$) and the test statistic for kurtosis was 113.28 ($p < 0.001$). With respect to those without intellectual disability, Mardia's test statistic for skew (5703.85, $p < 0.001$) and kurtosis (40.41, $p < 0.001$) were significant; for those with intellectual disability, these test statistics were also significant (skew: 6377.39, $p < 0.001$; kurtosis: 51.23, $p < 0.001$). Due to the test statistics being statistically significant for the entire sample and for those with and without intellectual disability, we concluded that the SDI:AR items were not multivariate normal (Mardia, 1970) and in response elected to use the robust maximum likelihood estimator in Mplus for all latent variable models.

Research Question 1 – Factor Structure

Using the entire sample (i.e., those with and without intellectual disability), we set out to determine the dimensionality of self-determination in the adult population. Specifically, we compared the three-factor model to the single-factor model.

Three-factor model (χ^2 = 366.8, df:186, p < 0.001). We first examined a three-factor solution to test whether the three constructs (volitional action, agentic action, and action-control beliefs) of Casual Agency Theory would emerge as separate constructs. Consistent with previous research with the SDI:SR (Shogren, Shaw, et al., 2018a), we found high correlations among the three constructs (0.95 or greater). This finding suggests great overlap among these constructs, and we therefore analyzed a single factor model moving forward.

Single-factor model (χ^2 = 378.1, df:189, p < 0.001). The fit of the initial single factor model of self-determination was unclear. Specifically, the absolute fit indices indicated acceptable fit with a RMSEA of 0.066 and a SRMR of 0.052; while, the incremental fit indices indicated unacceptable fit with the CFI and TLI being estimated to be 0.895 and 0.883, respectively. Because the CFI ad TLI fell below 0.90 we investigated sources of local misfit (e.g., were specific items creating difficulties in model fit). Through this process, we identified two items whose bivariate relationships were either severely under or overestimated. The offending items were: "*I choose what my room looks like*" (volitional action) and "*I know my strengths*" (action-control beliefs).

Reduced single-factor model (χ^2 = 289.9, df:152, p < 0.001). After removing these items, global model fit improved. Specifically, the RMSEA was 0.063, the CFI and TLI was 0.909 and 0.898, respectively, and the SRMR was estimated to be 0.05. Due to the TLI estimate not being greater than 0.90 we again investigated local misfit. We found the item, "*I think of more than one*

way to solve a problem" (agentic actions) contained 8 problematic bivariate relationships and as such, we removed this item from the model.

Final single-factor model (χ^2 = 239.7, df:135, p < 0.001). This further reduced single-factor model was found to have acceptable fit. Specifically, the RMSEA was 0.058, the CFI and TLI was 0.926 and 0.916, respectively, and the SRMR was estimated to be 0.047. Due to the RMSEA and SRMR being less than 0.06 and the CFI and TLI being greater than 0.90 we concluded this model meet established criteria for further analyses and interpretation.

With respect to the factor loadings, we found their standardized estimates to range from 0.598 to 0.918. Using these standardized factor loadings, we can estimate indicator reliability which corresponds to the proportion of observed variance explained by the latent variable. For instance, "*I come up with ways to reach my goals*" had the largest standardized loading at 0.918, therefore, the latent construct of self-determination explained 84.3% of its observed variance. Relative to the other 17 SDI:AR items, it can be inferred that this item can more efficiently discriminate between those with high and low levels of self-determination. With respect to the manifest intercepts, it is expected for those with average levels of self-determination, to score somewhere between 75.6 and 85.9 across the 18 SDI:AR items. Next, we estimated omega hierarchical to be 0.952.

In sum, based on the large estimate of omega hierarchical, representing construct reliability, and acceptable data-model fit, the findings support construct validity and suggest that these 18 items are reliable for adults with and without intellectual disability, although further research is needed across larger, representative samples.

Research Question 2

Having established an appropriate structure for the SDI:AR; 18 items loading on a single self-determination construct in the adult population, we next examined measurement invariance across those with and without intellectual disability (i.e., as a whole, do the reduced set of SDI:AR items function the same for those with and without intellectual disability). For this exercise, those without intellectual disability served as the reference group.

Form invariant model. The initial MG-CFA model was the form invariant model in which the single factor model was estimated simultaneously using the same form of identification for both those with and without intellectual disability, resulting in unique estimates across groups. This model had a RMSEA of 0.094, a CFI and a TLI of 0.847 and 0.827, respectively, and a SRMR of 0.066.

Metric invariant model. Next, following the procedures described in the Method section, the factor loadings of the 18 items were constrained to be the same across groups and the latent variance for those with intellectual disability was freely estimated. The change in CFI between the form invariant model and this metric invariant model was less than 0.01 and therefore, we established metric invariance.

Scalar invariant model. In a similar fashion, we constrained the manifest intercepts to be the same while freeing the latent mean for those with intellectual disability. The change in CFI between the metric invariant model and this scalar invariant model was 0.015. Due to the difference being greater than 0.01 we concluded that full scalar invariance was not tenable. Next, we investigated partial scalar invariance and identified, via local misfit, a stark difference between groups for the expected score (or intercept) of the item "*I figure out ways to get around obstacles*"; as such, we ran a partial scalar invariant model.

Partial scalar invariant model. After we freely estimated the intercept for the item identified above, this parameter was estimated to be 85.92 for those without intellectual disability versus 77.16 for those with intellectual disability. Moving from the metric invariant model to this partial scalar invariant model, we observed a change in CFI of less than 0.01 and concluded that partial scalar invariance had been reached.

Please see Table 3 for all relevant modeling details for Research Question 2.

Research Question 3

After establishing metric invariance, we were able to investigate group difference on the latent variance of self-determination; and in a similar fashion, by establishing partial scalar invariance we were able to investigate group differences on the latent self-determination mean (Byrne et al., 1989). Due to using the robust maximum likelihood estimator it was not appropriate to conduct traditional chi-square difference tests, instead, it was necessary to take into account the scaling correction factor (Satorra & Bentler, 2001). The scaling correction factor is used to adjust the chi-square value, as if normal theory maximum likelihood was utilized, thus, affording the appropriate chi-square difference test to ensue. Regardless of whether the comparison is being made with respect to the latent variance or mean, the partial scalar invariant model was used as the comparison model.

Latent variance comparison. To compare groups on the latent variance, we constrained the latent variances to be the same across groups by fixing the latent variance to 1.0 for those with intellectual disability (i.e., for identification purposes this is fixed to 1.0 for the group without intellectual disability). After conducting the appropriate model comparison test, the change in chi-square was significant ($\Delta\chi^2_{df:1}=21.2$; $p < 0.001$). Therefore, the latent variances could not be constrained to be the same across groups.

Latent mean comparison. In a similar manner, the latent means were constrained to be the same by fixing the latent mean to 0.0 for those with intellectual disability. This constrained model provided worse fit as indicated by the nested model comparison ($\Delta\chi^2_{df:1}$=26.8; $p < 0.001$), therefore, the constraint on the latent mean was not tenable across groups.

See Table 3 for all model information for latent invariance models.

Final model. By failing to establish latent invariance of the latent variance and mean, we recognize that the partial scalar invariant model provides the most parsimonious representation of the self-determination construct for those with and without intellectual disability. A significant difference in mean overall self-determination was observed between groups: 0.0 for those without intellectual disability versus -0.618 (SE = 0.239) for those with intellectual disability. Significant differences in the variability of self-determination also emerged: 1.0 for those without intellectual disability and 3.624 (SE = 1.063) for those with intellectual disability.

Effect size. To better understand the group differences latent d was estimated using the following equation per Hancock (2001) which provides an acceptable effect size when differences exist on the latent variance:

$$Latent\ d = \frac{\alpha_{2j} - \alpha_{1j}}{\sqrt{\frac{n_1\psi_{1j} + n_2\psi_{2j}}{n_1 + n_2}}}.$$

In the above formula, α corresponds to latent means, ψ corresponds to latent variances, and n corresponds to group sample sizes. Assigning those with intellectual disability the subscript 2, we estimated latent d to be -0.41 and corresponded to a medium effect size.

Discussion

The intent of the present analysis was to examine the reliability and factor structure of the SDI:AR in adults with and without intellectual disability. There is a dearth of contemporary assessment tools validated for adults that that measure overall self-determination that are aligned

with Causal Agency Theory. Such tools are critical, however, given the importance placed on promoting and enhancing self-determination in the intellectual and developmental disability field (Shogren, Abery, et al., 2015). There is a critical need for tools that can be used for outcome evaluation and to examine change in self-determination as a result of interventions and supports. This is particularly important given the growing focus across fields on the importance of self-perceptions of health and quality of life, including the movement toward patient-centered outcome measurement in in the health field (Mercieca-Bebber, King, Calvert, Stockler, & Friedlander, 2018; Weldring & Smith, 2013).

We first examined the factor structure of the SDI:AR, and found that items representing self-determination and its essential characteristics (volitional action, agentic action, and action control beliefs) were highly correlated and that the items were best modeled as a an overall self-determination construct, consistent with findings on the SDI:SR, validated with adolescents aged 13-22 (Raley et al., in press; Shogren, Little, et al., in press). This suggests the strong interrelationship of these constructs; however, ongoing work is needed to explore their development over time, particularly throughout adulthood, exploring if there may be changes associated with differing life stages or experiences (Abery & Stancliffe, 2003). We did find that three items that were included in the SDI:SR created issues with model fit on the SDI:AR, leading to us dropping them from our ongoing analyses. Because of the preliminary nature of the present study, we suggest that further work be done to determine if these items consistently create issues with model fit in adult populations and should be dropped from the SDI:AR to ensure that there were not specific features of the present sample that led to differences. We also recommend comparative work be undertaken across adolescent and adult populations, as these items did not create issues with model fit on the student report version of the scale.

The three items that were problematic (*I choose what my room looks like; I think of more than one way to solve a problem; I know my strengths)* each represented one of the essential characteristics of self-determination, volitional action, agentic action, action control beliefs, respectively. The first, regarding choosing what one's room looks like may not have the same degree of relevance in adulthood, except perhaps for people with intellectual disability living in restrictive settings. However, the other two items and the reasons why they led to model misfit needs further exploration; are they not the best representation of these concepts in adulthood, are they better captured with other items, is there different terminology or experiences in adulthood that shapes their relevancy? As noted, ongoing data collection and exploration of item content in adulthood is needed to determine if these items should be dropped from the scale or if there were sample specific characteristics that influenced these findings. However, the results suggest that the 18 items assess key aspects of self-determination with high reliability with good model fit to the construct of self-determination for adults with and without intellectual disability.

Our next question, then, was to examine if the SDI:AR functioned the same for adults with and without intellectual disability. It has been established that across adolescents with a wide array of disability labels, including intellectual disability, the items function the same way, meaning that the same set of items can be used across populations (Shogren, Little, et al., in press). Establishing this in adults is also important, particularly to enable future comparative work across adults with and without intellectual disability in their self-determination outcomes. We were able to establish metric invariance, meaning the factor loadings were equivalent across adults with and without disabilities; we also established partial scalar invariance, suggesting that with the exception of one item, *I figure out ways to get around obstacles* (agentic action), the items could be equated with respect to their intercepts. For this one item, there were however

large differences across those with and without intellectual disability, suggesting that the score on this item is significantly lower for those with intellectual disability (77.16 vs. 85.92 in those without intellectual disability). This suggests that this particular aspect of self-determination, navigating around obstacles, may be something that is highly discrepant across adults with and without intellectual disability, suggesting the need for more attention in research and practice.

Although there was a difference on this one item, by establishing partial scalar invariance, we were able to compare latent self-determination means and variances across the two groups, and we found that there were significant differences both in means and latent variances. In terms of the variability of scores, this parameter was three times greater for adults with intellectual disability than those without disabilities, suggesting a significantly greater range of scores in adults with intellectual disability. The implications of this for future self-determination assessment and intervention need to be fully explored, as it is likely that using assessment to develop targeted self-determination may be useful, given the variability in expressed self-determination. Overall, it also suggests that, in practice, there may be a need for differentiated and targeted interventions in adulthood. For example, the results of self-determination assessment may help identify key goals to target for a person related to specific self-determination skills and opportunities.

The data also suggests that at the mean level, there remain significant disparities in self-determination in adulthood for those with intellectual disability, consistent with finding in adolescents (Shogren, Shaw, et al., 2018a). Adults with intellectual disability score 0.618 (SE = 0.239) units lower than those without disabilities. This difference corresponded to an effect size of -0.41, which is characterized as medium, suggesting the need for ongoing efforts to enhance supports and opportunities for self-determination throughout adulthood for adults with

intellectual disability. As noted previously, the results also suggest that navigating around barriers when working toward goals may be a particularly important area to consider, as this item was much more discrepant than the overall differences (-0.618 units).

Limitations

These preliminary findings on the use of the SDI:AR in adults with intellectual disability are useful to guide ongoing work, although there is a need to acknowledge the limitations. First, there were a small number of adults in each group, and larger samples are needed to more fully explore the functioning of items and the best set of items across the adult life course. Further, participants need to be able to access and engage with the online delivery platform; this restricts the population that participated in the study and ongoing work is needed to explore ways to reach those with intellectual disability that may not have reliable and meaningful access to the online tool. Relatedly, we were unable to analyze other contextual factors (Shogren, Luckasson, & Schalock, 2014) that may influence self-determination outcomes, including personal factors (e.g., age, gender, race/ethnicity) and environmental factors (e.g., living arrangement, employment, educational opportunities). Previous research with adolescents has suggested an interaction of disability status, race/ethnicity, and socioeconomic status in explaining self-determination scores (Shogren, Shaw, et al., 2018a). Additionally, we did not independently verify self-reported disability status or collect formal data on the intensity of supports needed by the sample of adults with intellectual disability, which should be a direction for future research. Understanding the accuracy of reporting of intellectual disability and support needs in a sample of adults with intellectual disability would inform the reliability of such procedures in future research.

Finally, there is a need to examine differences in self-determination across the adult life course, it may be that there are differences based on age or life stage (early adulthood, middle adulthood, late adulthood) (Smith, 2009), which would be consistent with differences seen during pre-adolescence, adolescence, and transition on the SDI:SR, with younger people scoring lower (Shogren, Shaw, et al., 2018b). Research has not systematically examined the impact of aging through adulthood on self-determination outcomes and more work is needed. Additional work is also needed to explore the viability of proxy-responding on the SDI: AR, as we did not collect any proxy-responses of behavioral observations of the expression of self-determination in the sample. Currently, we have not explored the relationship between proxy-report and self-report on the SDI:AR. Such work is needed to understand how others perceive the self-determination of those they support, as well as to explore ways to promote the collection of information on self-determination in adults with extensive support needs that cannot engage with current assessment tools, like the SDI:AR. Work on the SDI:SR suggests that there are large discrepancies between self- and proxy-report (Shogren, Anderson, et al., in press) and determining if the same issues emerge in adulthood is a critical area for future research. Additionally, exploring ways to capture data on the self-determination of adults with extensive support needs through behavioral observation or other means is a critical area to engage all adults with intellectual disability in data collection on self-determination.

Conclusions and Future Directions for Research and Practice

Overall, these preliminary findings suggest that the SDI:AR is a valid and reliable tool for use with adults with intellectual disability, as well as adults without disabilities. There is a need to expand the use of self-determination assessment in research and practice evaluation outcomes and the attainment of the goals of disability policy, namely the promotion of self-

determination. The SDI:AR is delivered online and promotes accessibility and usability for people with disabilities across the life course. There are an array of research questions regarding the development and expression of self-determination in adulthood that need to be explored, as well as work examining the sensitivity of the tool as an outcome measure and to evaluate the efficacy and effectiveness of specific interventions and supports. More work is also needed to conceptualize self-determination across the adult life course, to explore the impact of aging and changes in life stages and design effective, individualized supports to ensure that self-determination is meaningfully supported across the life course.

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Table 1

Sample demographics

	Intellectual Disability N = 115		No Disability N = 118		Total N = 233	
Characteristic	*n*	%	*n*	%	*n*	%
Gender						
Male	50	43.48	51	43.22	101	43.35
Female	62	53.91	66	55.93	128	54.94
Age						
M (SD)	34.55 *(15.50)*		36.61 *(12.55)*		35.59 *(14.09)*	
Race/Ethnicity						
Hispanic or Latinx	16	13.91	29	24.58	45	19.31
American Indian/Alaska Native	2	1.74	2	1.69	4	1.72
African American/Black	16	13.91	16	13.56	32	13.73
Native Hawaiian or Pacific Islander	0	0.00	2	1.69	2	0.86
White/Caucasian	78	67.83	92	77.97	170	72.96
Asian	3	2.61	3	2.54	6	2.58
Two or more races	3	2.61	2	1.69	5	2.15
Other	8	6.96	1	0.85	9	3.86
Education						
Formal schooling but no diploma or GED	30	26.09	3	2.54	33	14.16
High school graduate (diploma or GED)	62	53.91	9	7.63	71	30.47
Vocational/technical school	2	1.74	6	5.08	8	3.43
Some college, but no degree	11	9.57	32	27.12	43	18.45
Associate degree (AA, AS, etc.)	5	4.35	14	11.86	19	8.15
Bachelor's degree (BA, BS, etc.)	4	3.48	31	26.27	35	15.02
Graduate Degree (MS, MA, PhD, etc.)	0	0.00	21	17.80	21	9.01

Employment						
Full time	17	14.78	73	61.86	90	38.63
Part time	30	26.09	22	18.64	52	22.32
Workshop	19	16.52	4	3.39	23	9.87
Paid Intern	3	2.61	3	2.54	6	2.58
Unpaid Intern	7	6.09	3	2.54	10	4.29
Looking	8	6.96	2	1.69	10	4.29
Not Working	24	20.87	5	4.24	29	12.45
Retired	1	0.87	2	1.69	3	1.29
Other	3	2.61	0	0.00	3	1.29
Residence						
Own Home/Apartment	16	13.91	39	33.05	55	23.61
Family Living Arrangement	65	56.52	77	65.25	142	60.94
Group Home	27	23.48	2	1.69	29	12.45
Other	6	5.22	0	0.00	6	2.58
Level of Support						
No support needed	3	2.61	67	56.78	70	30.04
A little support needed	62	53.91	43	36.44	105	45.06
A lot of support needed	41	35.65	6	5.08	47	20.17
Support needed all the time	8	6.96	1	0.85	9	3.86

Note. M = Mean, SD = Standard Deviation.

Table 2

Descriptive statistics of SDI:AR items and internal consistency

	Overall Sample				With Intellectual Disability				Without Intellectual Disability			
Item	n	mean	sd	n missing	n	mean	sd	n missing	n	mean	sd	n missing
1	221	75.47	25.77	12	107	73.64	29.04	8	114	77.19	22.26	4
2	220	83.54	18.94	13	107	81.91	22.64	8	113	85.09	14.54	5
3	220	84.25	20.71	13	107	81.73	25.13	8	113	86.63	15.12	5
4	217	80.29	23.41	16	107	74.14	29.22	8	110	86.28	13.48	8
5	221	81.31	21.14	12	107	76.43	25.70	8	114	85.89	14.39	4
6	223	81.17	21.89	10	108	79.35	25.20	7	115	82.89	18.18	3
7	217	79.95	22.33	16	108	74.97	26.28	7	109	84.89	16.23	9
8	221	80.53	21.59	12	108	77.14	26.13	7	113	83.77	15.54	5
9	222	80.46	22.50	11	108	76.81	26.32	7	114	83.92	17.60	4
10	218	77.65	25.82	15	108	70.59	31.80	7	110	84.58	15.40	8
11	224	78.69	23.02	9	107	70.89	27.79	8	117	85.82	14.35	1
12	221	81.10	21.73	12	107	77.18	26.76	8	114	84.77	14.82	4
13	221	82.57	23.60	12	107	77.88	29.23	8	114	86.98	15.57	4
14	216	80.60	22.36	17	106	76.01	28.21	9	110	85.02	13.39	8
15	219	85.95	18.97	14	107	82.76	23.51	8	112	89.01	12.64	6
16	214	81.50	21.43	19	103	79.10	26.63	12	111	83.72	14.86	7
17	226	79.75	22.72	7	109	77.09	26.43	6	117	82.23	18.39	1
18	221	81.40	20.56	12	106	78.19	24.78	9	115	84.36	15.23	3
19	218	81.20	22.44	15	108	77.66	27.36	7	110	84.68	15.59	8
20	222	85.41	19.10	11	107	83.51	23.11	8	115	87.18	14.28	3
21	221	81.10	21.60	12	108	78.37	25.48	7	113	83.72	16.80	5
Alpha [95% C.I.]		0.96 [0.96, 0.97]				0.97 [0.96, 0.98]				0.95 [0.93, 0.96]		

Table 3

Measurement and latent invariance

Step	Model	χ2	df	Scaling Factor	Δχ2	Δdf	p-value	RMSEA	CFI	TLI	SRMR	Tenable
1	Form	543.311	270		-	-	-	0.094	0.847	0.827	0.066	Yes
2	Metric	554.551	287		-	-	-	0.090	0.850	0.840	0.087	Yes
3	Scalar	597.873	304	1.4505	-	-	-	0.092	0.835	0.834	0.096	No
	†Reduced											
3.1	Scalar	586.357	303	1.4513	-	-	-	0.090	0.841	0.840	0.094	Yes
4	Latent Variance	614.392	304	1.4530	21.204	1	0	0.094	0.826	0.825	0.364	No
5	Latent Mean	593.897	304	1.4476	26.785	1	0	0.091	0.838	0.837	0.104	No

Note. Step 3.1 corresponds to partial scalar invariance model, † = final model