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ORIGINAL PAPER

Exploring the Relationships among Basic Psychological Needs Satisfaction and Frustration, Agentic Engagement, Motivation, and Self-Determination in Adolescents with Disabilities

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Abstract
Researchers have separately explored applications and implications of the Self-Determination Theory (SDT) and Causal Agency Theory in the school context; however, limited attention has been directed to examining the relations between constructs emerging from SDT (agentic engagement, motivation, and basic needs satisfaction and frustration) and the Causal Agency Theory (self-determination and its essential characteristics—volitional action, agentic action, and action-control beliefs), as well as the use of measures developed to assess these constructs in adolescents with disabilities. We examined the reliability of measures emerging from both theories in adolescents with disabilities, and explored the pattern of means, correlations, and predictive relations among the constructs. We found adequate reliability, and unique patterns of correlations and predictive relationships among the constructs. Adolescents with disabilities showed higher levels of need satisfaction than frustration, as well as moderately high levels of self-determination and agentic engagement, consistent with other research with students with and without disabilities. The findings highlight the role of constructs from positive psychology in the lives of students with and without disabilities and the need for more research that includes students with disabilities and explores their experiences alongside their peers without disabilities in developing causal agency.

Keywords Causal Agency Theory · Self-Determination Theory · Adolescence · Disability · Measurement · Schools

Human agentic theories, including theories of self-determination, assume that each person actively shapes his or her environment and that each person is driven to be an active contributor to, or *agent* of, his or her own behavior (Little et al. 2006; Wehmeyer et al. 2017). Within the field of motivational psychology, the Self-Determination Theory (SDT) adopts the assumptions of human agentic theories and attempts to explain human motivation, namely differences between autonomous and controlled types of motivation. SDT suggests that social contexts can motivate human action to meet three basic psychological needs, the need for autonomy, competence, and relatedness (Deci 1980, 1992; Deci and Ryan 2002, 2012), and describes these basic psychological needs as an "energizer of behavior" (Deci and Ryan 2012, p. 101) that, when satisfied, contribute to intrinsic, or autonomous, motivation and, when frustrated, lead to extrinsic motivation. It is critical, as such, to create social contexts that address these basic psychological needs (i.e., autonomy-supportive contexts) and, in doing so, promote autonomous motivation (Deci and Ryan 2012). As adolescents become intrinsically motivated, this has the potential to further enhance their ability to engage in self-determined actions to address their basic psychological needs.

SDT differs from other theories in its differentiation of autonomous and controlled motivation (Deci and Ryan 2012). Specifically, SDT posits that motivation occurs along a continuum ranging from: (1) external regulation, (2) introjected regulation, (3) identified regulation, and (4) intrinsic motivation. Motivation across contexts will be influenced by the degree environments support intrinsic motivation or autonomous regulation of one's behavior versus the degree

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to which environments promote external control or regulation by other people or environmental contingencies. The degree to which environments satisfy versus thwart basic psychological needs for autonomy, competence, and relatedness influence where youth fall on the motivation and internal versus external regulation continuums as well as psychological well-being (Deci and Ryan 2012; Ryan and Deci 2011). The importance of intrinsic or autonomous motivation and the satisfaction of basic psychological needs has been widely documented (Reeve et al. 2004; Vansteenkiste and Ryan 2013; Vansteenkiste et al. 2012), including the role of classrooms that support autonomy, competence, and relatedness need satisfaction in enhancing student academic outcomes (De Naeghel et al. 2014; Niemiec and Ryan 2009).

Researchers have also examined the impact of motivation and basic psychological need satisfaction and frustration on student engagement in classrooms, a critical variable in positive classroom functioning (Jang et al. 2012). Engagement has been described as a multi-dimensional construct, and Reeve (2013) proposed agentic engagement as a new aspect of student engagement, which differs from behavioral, emotional, and cognitive engagement in its focus on student initiation and contributions to instructional environments, or focusing on how students proactively contribute to instruction by asking questions and communicating their wants and needs, rather than waiting on teachers to initiate or direct the process. Researchers have found that agentic engagement makes unique contributions to student motivation, and that this relationship may be reciprocal with autonomous motivation influencing agentic engagement and vice versa over time (Reeve and Lee 2014). This suggests the importance of understanding basic psychological need satisfaction and frustration, motivation, and engagement in adolescents with and without disabilities.

In the disability field, the construct of self-determination has also received significant attention. In the 1990s, researchers began to acknowledge the frequency and detrimental impact of controlling environments on the self-determination and postschool outcomes of adolescents with disabilities (Blackorby and Wagner 1996). Funding was provided by the U.S. Department of Education, in the early 1990s, to develop theoretical frameworks, assessments, and interventions to enhance student self-determination (Ward 2005), focusing explicitly on adolescents with disabilities in recognition of this group's restricted opportunities to make and express choices and self-direct their lives and learning. It was hypothesized that the lack of opportunities for self-direction contributed to less positive postschool outcomes. The functional model of self-determination was introduced by Wehmeyer (1992, 1999, 2003) to describe the function of self-determined behaviors for adolescents with disabilities, recognizing the role of volitional action in enabling adolescents with disabilities to act as a causal agent in their lives. From this, interventions such as the Self-Determined Learning Model of Instruction (Wehmeyer et al. 2000) were developed for special education teachers to use to reorient their instruction to be student-directed and explicitly teach adolescents with disabilities self-regulated problem-solving skills that would enable them to take advantage of the changes in the teachers' model of instruction, utilizing student-directed learning strategies.

The Causal Agency Theory (Shogren et al. 2015a) was recently introduced, building on the functional theory, but incorporating more explicitly elements of SDT into the theoretical framework for understanding how adolescents with and without disabilities learn and can be supported to engage in causal actions, defined by volitional and agentic action (see Fig. 1). Essentially, the Causal Agency Theory focuses on how autonomy-supportive interventions, such as the Self-Determined Learning Model of Instruction, can be used in autonomy-supportive contexts to enhance causal agency, student self-determination, and other outcomes.

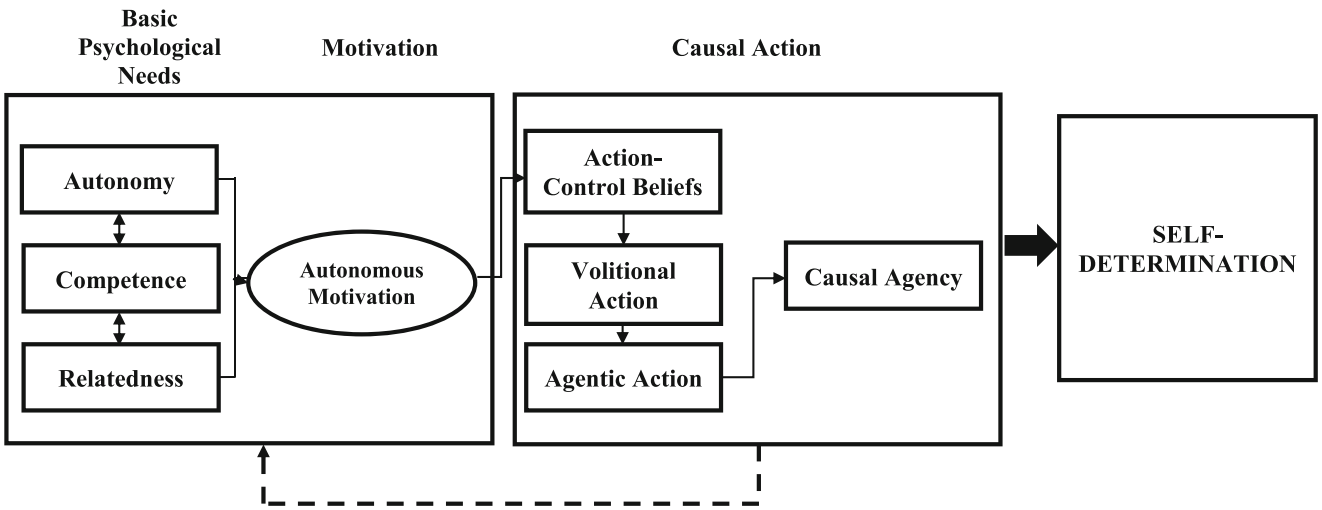

Fig. 1 Relationship between basic psychological needs, motivation, causal action, and self-determination (Shogren and Wehmeyer 2016)

Researchers have separately explored applications and implications of SDT and the Causal Agency Theory in school contexts (Reeve 2002a; Wehmeyer and Shogren 2017b), given the centrality of this environment for adolescents. However, to date, the relations between constructs defined by the two theories have not been extensively explored. Further, while the Causal Agency Theory has been explored in the disability context (Wehmeyer and Shogren 2017a), SDT has received more limited attention in the disability context. Thus, the present study is part of a line of research to theoretically and empirically test the relationships among constructs associated with these two theories in adolescents with and without disabilities, although the present analysis focused explicitly on adolescents with disabilities. The goal of this study was to explore the relations between constructs emerging from SDT (agentic engagement, motivation, and basic needs satisfaction and frustration) and the Causal Agency Theory (self-determination and its essential characteristics—volitional action, agentic action, and action-control beliefs), as well as the use of measures developed to assess these constructs in adolescents with disabilities. Further, we were also interested in preliminarily exploring the degree to which constructs associated with SDT predicted self-determination, as defined by the Causal Agency Theory (see Fig. 1). As such, we had three research questions. First, how reliable are the measures associated with the Self-Determination Theory and Causal Agency Theory in adolescents with disabilities? Second, what are patterns of means and correlations among constructs associated with the Self-Determination Theory and Causal Agency Theory in adolescents with disabilities? And third, to what degree do constructs associated with the Self-Determination Theory predict self-determination?

Method

Participants

Adolescents with disabilities ($n = 55$) aged 12 to 19 years ($M = 15.8$; SD = 1.5 years) who attended a private school for students with social and academic support needs participated in the study. The school's curriculum focuses on supporting students who experience social and academic challenges because of learning differences. As such, all participating students had learning disabilities. The majority also had additional diagnoses including attention deficit hyperactivity disorder (ADHD; $n = 17$, 31%), autism ($n = 10$, 18%), as well as both ADHD and autism ($n = 26$, 47%). Most of the participants were male ($n = 38$, 69%) ranging in age from 12 to 18 years ($M = 15.7$; SD = 1.56). Female participants ($n = 13$, 24%) ranged in age from 13 to 19 years ($M = 16.2$; SD = 1.42). Further, 67% of participants identified as White ($n = 37$), although students from other racial or ethnic groups were also represented in the sample. Table 1 provides additional demographic information.

Procedures

A school administrator interested in enhancing efforts to promote self-determination contacted the research team about the Self-Determination Inventory: Student Report (SDI:SR; Shogren and Wehmeyer 2017), a measure of self-determination (described subsequently) aligned with the Causal Agency Theory developed by the research team. Following several discussions with regard to shared research interests, it was decided that an initial step for this collaboration would be to explore relationships among constructs across the two theories. The school administrator shared information of the purpose of the study with participants and their guardians. With assent from the students, school personnel administered the assessments in individual or group settings using an online or paper-based format depending on students' instructional preferences. It took students between 20 and 30 min to complete the measures. Support (i.e., rephrasing questions or deciphering words) was provided as

Table 1 Demographic characteristics of the sample

	$n = 55$	
Characteristic	*n*	Percent
Disability		
ADHD	17	30.9
Autism	10	18.2
ADHD and autism	26	47.3
Other[a]	2	3.6
Gender		
Male	41	74.5
Female	14	25.5
Age		
12–13	8	14.5
14–15	15	27.3
16–17	26	47.3
18–19	6	10.9
M	15.7	(SD = 1.7)
Ethnicity		
White	37	67.3
Hispanic or Latino origin	4	7.3
Black	3	5.5
Asian	5	9.1
Two or more races	4	7.3
Other	2	3.6

ADHD attention deficit hyperactivity disorder

[a] Other includes participants with a diagnosis of learning disability without an ADHD and/or autism diagnosis

needed by teachers for individual students, consistent with the administration protocol for the assessments.

Measures

Basic Psychological Need Satisfaction and Frustration The *Basic Psychological Needs Satisfaction and Frustration Scale* (BPNSFS; Chen et al. 2015) was developed to assess satisfaction and frustration of each of the basic psychological needs (autonomy, relatedness, and competence). The BPNSF is composed of 24 items which are measured on a 5-point scale from 1 (Not true at all) to 5 (Completely true). Chen et al. (2015) found a six-factor model best fit the data representing (1) autonomy satisfaction, (2) autonomy frustration, (3) relatedness satisfaction, (4) relatedness frustration, (5) competence satisfaction, and (6) competence frustration. The authors also fit two separate higher order factors of overall needs satisfaction and frustration, which showed unique relationships with indicators of well-being. The factor structure of the BPNSF has been validated with culturally diverse adolescents (Chen et al. 2015; Cordeiro et al. 2016; Nishimura and Suzuki 2016). However, it has not been utilized with adolescents with disabilities, although a version was developed for adults with intellectual disability (Frielink et al. 2016). Researchers have reported internal consistency values on the BPNSF in the range of .6 to .8.

Motivation To measure adolescent motivation in the school context, as defined by SDT, the *Academic Self-Regulation Questionnaire* (SRQ-A; Ryan and Connell 1989) was used. The SRQ-A was developed to assess student perceptions of why they complete their school work, as an indicator of motivation in the school context. Specifically, the degree to which students are motivated by intrinsic versus extrinsic factors is assessed. The standard version of the SRQ-A was developed for students in late elementary and middle school, and a modified version, which was used in this study, was created for students with learning disabilities (Deci et al. 1992). This version was adapted from the original to promote ease of response by changing questions from a multiple response format for each item to separate items. The modified SRQ-A is comprised of 17 items and responses range from 0 (Never) to 4 (Always). Within the questionnaire, there are four subdomains representing the continuum of extrinsic to intrinsic motivation: (1) external regulation, (2) introjected regulation, (3) identified regulation, and (4) intrinsic motivation. Research on the SRQ-A has suggested Cronbach's alpha of 0.66 to 0.82, indicating moderate to high levels of internal consistency (Ryan and Connell 1989).

Agentic Engagement The *Agentic Engagement Scale* (AES; Reeve 2013) was used to measure the extent to which students constructively contribute to the instruction they receive. Specifically, the AES was designed to measure agentic engagement as defined by Reeve. The AES contains five items that range from 1 (Strongly disagree) to 7 (Strongly agree). Previous research on the AES has suggested acceptable levels of internal consistency (Cronbach's alpha > 0.8) for middle and high school students, as well as college students, without disabilities.

Self-Determination Adolescent self-determination was measured using the pilot version of the Self-Determination Inventory: Student Report (SDI:SR; Shogren et al. 2014b). The SDI:SR is a self-report measure operationalizing the Causal Agency Theory. It was developed to measure the three essential characteristics of self-determined action (volitional action, agentic action, and action-control beliefs) as well as overall self-determination as defined by the Causal Agency Theory in adolescents aged 13 to 22 with and without disabilities. The pilot measure is composed of 51 questions, the majority of which are rated via an online sliding scale that ranges from 0 to 100 with the anchors of Disagree and Agree. There is also a subset of means-end problem-solving items, where students are instructed to provide the best response to complete a story with a beginning and end. Pilot testing of the SDI:SR suggested an equivalent factor structure across adolescents with and without disabilities, as well as adequate reliability in both populations (Shogren et al. 2017).

Data Analyses

To address the three research questions, a series of analyses were undertaken. As all measures were originally on differing scales, the proportion of maximum scaling (POMS) method (Little 2013) was used in which the transformed scale across items ranged from 0 (lowest score) to 1 (highest score). This method has been utilized in previous studies by the research team (Shogren et al. 2014a, 2015b). Following transformation, reliability coefficients were calculated at the scale and subscale level (as appropriate) for each of the measures. Because this investigation of the relationships between the measures is in the early stages of inquiry, the criterion for acceptable reliability was determined to be 0.7 or higher prior to data analysis (Nunnally 1978) as the squared value of this reliability would indicate that 50% of a measure or subscale's variance can be explained (Raykov and Marcoulides 2011). Next, descriptive statistics were calculated, as well as Pearson's *r* for overall measure correlations and subscale measure correlations. The correlations were also interpreted in terms of effect sizes 0.10, 0.30, and 0.50 indicating weak, medium, and strong correlations, respectively. Finally, we conducted a forward step-wise regression to explore the degree to which constructs associated with the Self-Determination Theory (agentic engagement, motivation, need satisfaction, and frustration) predicted overall SDI:SR scores.

An α level of 0.05 was used when evaluating all correlations and regression predictors. Further, the proportion of variance accounted for (R^2) in each overall measure and construct's prediction of SDI:SR overall score was examined. The R^2 reveals how relevant each construct associated with the Self-Determination Theory was to the SDI:SR, and thus measuring the relevance of Self-Determination Theory constructs to those of the Causal Agency Theory. All analyses were completed in SPSS, Version 22 (2013).

Results

The first analysis examined the reliability of the scales and subscales of the measures associated with SDT and the Causal Agency Theory with adolescents with disabilities. As shown in Table 2, there was some variability in the reliability of measures and associated subscales with some falling under the previously determined criterion of 0.70 or higher. The subscales of Identified Regulation on the SRQ-A, Relatedness Frustration on the BPNSF, and Volitional Action on the SDI:SR showed reliability below the identified criterion; however, those reliabilities, all > 0.60, were close to the threshold. However, Agentic Action ($\alpha = 0.454$) on the SDI:SR and Autonomy Satisfaction ($\alpha = 0.460$) on the BPNSF showed lower reliability values.

Next, we explored the means (see Table 2) and correlations (see Table 3) of the scales and subscales. Overall, students had relatively high means on the SDI:SR and its associated constructs and BPN Satisfaction (0.77) in comparison to BPN Frustration (0.46) and its associated subscales. The Intrinsic Motivation subscale within SRQ-A demonstrated lower average scores in comparison to other subscales on the SRQ-A, which may be explained by the fact that intrinsic motivation develops with age and maturation. In terms of the patterns of correlations, the results suggest that the SDI:SR correlated strongly with the BPN Satisfaction constructs ($r = 0.609$), moderately with the SRQ-A ($r = 0.404$), and strongly with the AES ($r = 0.587$) as shown in Table 3. Further, the SDI:SR and frustration constructs within the BPNSF were marginally negatively correlated ($r = -0.103$). Satisfaction as measured by the BPNSF correlated moderately with the SRQ-A ($r = 0.351$) and strongly with the AES ($r = 0.645$). Conversely, BPN Frustration demonstrated a weak effect size with all other measures, including BPN Satisfaction ($r = -0.086$).

Table 2 Measure and subscale descriptive statistics

	Number	*M*	SD	Range	
SDI:SR	55	0.72	0.120	0.48	0.927
Volitional action	55	0.72	0.139	0.56	0.626
Agentic action	55	0.68	0.145	0.59	0.454
Action-control beliefs	55	0.77	0.154	0.57	0.880
BPN satisfaction	54	0.77	0.141	0.48	0.782
Autonomy satisfaction	54	0.74	0.158	0.69	0.460
Related satisfaction	53	0.81	0.156	0.51	0.692
Competence satisfaction	53	0.76	0.193	0.98	0.738
BPN frustration	54	0.46	0.209	0.79	0.821
Autonomy frustration	54	0.58	0.220	0.94	0.729
Related frustration	54	0.38	0.231	0.85	0.627
Competence frustration	54	0.43	0.276	0.98	0.827
SRQ-A	53	0.61	0.196	0.80	0.895
External regulation	53	0.63	0.276	1.00	0.871
Introjected regulation	53	0.59	0.231	0.92	0.839
Identified regulation	53	0.68	0.266	1.00	0.667
Intrinsic motivation	53	0.53	0.254	0.99	0.758
AES	54	0.77	0.191	0.80	0.769

At the subscale level with the measures, as shown in Table 4, the SDI:SR subscales exhibited strong correlations with one another, with the exception of the correlation between Agentic Action and Volitional Action, which displayed a medium-to-strong correlation ($r = 0.393$). The correlations among satisfaction constructs within the BPNSF were also moderate to strong as were subscales within the frustration construct. In alignment with its conceptual understanding, External Regulation as measured by the SRQ-A showed a weak correlation with Intrinsic Motivation ($r = 0.119$), as these constructs measure competing notions of the origin of motivation. Intrinsic Motivation was also only moderately correlated with Introjected Regulation ($r = 0.309$) and Identified Regulation ($r = 0.443$).

When looking at subscale correlations across measures, Volitional Action demonstrated moderate correlations with Autonomy Satisfaction ($r = 0.303$) and Relatedness Satisfaction ($r = 0.306$) of the BPNSF, and the AES ($r = 0.371$). Notably, all frustration subscales of the BPNSF were weakly correlated with Volitional Action, while the Competence Frustration ($r = -0.409$) subscale was moderately negatively correlated with Agentic Action. Action-Control Beliefs showed strong effect sizes with all satisfaction constructs of the BPNSF as well as with the AES ($r = 0.629$). All SRQ-A subscales aside from Intrinsic Motivation ($r = 0.102$) were moderately correlated with Volitional Action, and the correlation between Action-Control Beliefs and Identified Regulation ($r = 0.478$) was moderate.

To address the third research question, we conducted an exploratory forward step-wise regression (Table 5). The results demonstrated that Relatedness Satisfaction from the BPNSF alone was able to account for approximately 30% of the variance in SDI:SR overall scores, $F_{(1,\ 49)} = 22.824$, $p < 0.001$. A second model including the AES was able to account for an additional 6% of variance in SDI:SR overall scores, $\Delta F_{(1,\ 48)} = 6.176$, $p = 0.016$, but the other subscales did not significantly add to the model.

Table 3 Overall measure correlations

	SDI:SR	BPN satisfaction	BPN frustration	SRQ-A	AES
SDI:SR	1	0.609**	− 0.103	0.404**	0.587**
BPN satisfaction	54	1	− 0.086	0.351**	0.645**
BPN frustration	54	54	1	0.252	− 0.047
SRQ-A	53	53	53	1	0.377**
AES	54	54	54	53	1

Listed below the diagonal are sample sizes

**Correlation is significant at the 0.01 level (two-tailed)

*Correlation is significant at the 0.05 level (two-tailed)

Discussion

This study is part of a line of work exploring the relations between constructs emerging from SDT and the Causal Agency Theory in adolescents with and without disabilities. The focus of the present paper was to explore relations among specific constructs as hypothesized in the Causal Agency Theory (see Fig. 1), as well as explore the measurement of constructs from SDT in adolescents with disabilities. As such, we examined the reliabilities, means, correlations, and predictive relations among agentic engagement, motivation, basic needs satisfaction and frustration, and self-determination and its essential characteristics—volitional action, agentic action, and action-control beliefs.

In terms of reliability of the measures in a sample of adolescents with disabilities, including learning disabilities, autism, and ADHD, we found that at the scale and subscale level, the majority of the measures has adequate reliability properties. There were exceptions, with the lowest reliability scores for items from the Agentic Action subscale of the SDI:SR and the Autonomy Satisfaction subscale of the BPN scale. Previous studies of the SDI:SR have found similar results with regard to the Agentic Action subscale with a comparable sample of adolescents with disabilities, which may reflect that the items on this scale require responding to means-ends problem-solving items rather than simply responding to survey questions as required by the rest of the items on the scale (Shogren et al. 2017). Ongoing work is needed to explore the best ways to support adolescents with disabilities to effectively complete measures of their self-determination skills, as well as potential differences in adolescents with and without disabilities in these skills and resulting implications for intervention.

When looking at the means and correlations across the scales and subscales, expected patterns emerged, with adolescents with disabilities showing higher levels of need satisfaction than frustration, as well as moderately high levels of self-determination and agentic engagement, consistent with other research with students with and without disabilities (Jang et al. 2012; Shogren et al. 2017). Further research is needed, however, that directly compares students with and without disabilities. For example, examining if students with disabilities experience more need frustration and less agentic engagement, as the environments of people with disabilities often tend to be more controlling and less supportive of self-determination (Balcazar et al. 2012; Houghton et al. 1987), may be a direction for future research. Further, the finding that adolescents with disabilities tend to rate themselves highest on the identified regulation subscale and higher on the external and introjected regulation subscale than the intrinsic motivation subscale suggests that the youth fall in the range of being more motivated by external rather than intrinsic factors, reflecting the ongoing development of intrinsic motivation, but could also be influenced by environments that these students with disabilities are exposed to (Deci et al. 1992). Further research is needed that replicates these findings and explores the implications for the development of self-determination. Additionally, research is needed on the impact of autonomy-supportive classrooms and interventions to promote intrinsic motivation in adolescents with and without disabilities (Chang et al. in press; De Naeghel et al. 2014; Reeve 2002b).

Relatedly, the pattern of correlations across the constructs associated with the Self-Determination Theory and Causal Agency Theory suggests that differing constructs are being measured, but that there are clear relationships in expected directions between, for example, basic psychological need satisfaction and self-determination, motivation and self-determination, and agentic engagement and self-determination. As hypothesized by the Causal Agency Theory, basic psychological need satisfaction and intrinsic motivation are related to self-determination and its essential characteristics—volitional action, agentic action, and action-control beliefs—in students with disabilities. This suggests, as has been suggested for students without disabilities, that focusing on addressing basic psychological needs and promoting agentic engagement in classrooms relates to (Jang et al. 2012), and potentially influences, outcomes. Further research is needed that explores ways, in inclusive environments, to promote agentic engagement and intrinsic motivation for all students to enhance self-determination, well-being, and academic outcomes.

Table 4 Measure subscale correlations

	SDI:SR			BPN satisfaction			BPN frustration			SRQ-A				AES
	Volitional action	Agentic action	Action-control beliefs	Autonomy satisfaction	Relatedness satisfaction	Competence satisfaction	Autonomy frustration	Relatedness frustration	Competence frustration	External regulation	Introjected regulation	Identified regulation	Intrinsic motivation	
SDI:SR														
Volitional action	1	0.393**	0.551**	0.303*	0.306*	0.205	0.195	0.205	0.119	0.418**	0.363**	0.353**	0.102	0.371**
Agentic action	55	1	0.605**	0.226	0.366**	0.325*	−0.223	−0.278*	−0.409**	0.081	0.083	0.205	0.184	0.437**
Action-control beliefs	55	55	1	0.593**	0.707**	0.661**	−0.016	0.030	−0.185	0.171	0.290*	0.478**	0.253	0.629**
BPNSF														
Autonomy satisfaction	54	54	54	1	0.601**	0.487**	−0.001	0.028	−0.007	−0.058	0.298*	0.272*	0.183	0.482**
Relatedness satisfaction	53	53	53	53	1	0.580**	−0.031	−0.022	−0.181	0.023	0.348*	0.366**	0.233	0.528**
Competence satisfaction	53	53	53	53	53	1	−0.053	0.063	−0.248	0.08	0.169	0.484**	0.293*	0.601**
Autonomy frustration	54	54	54	54	53	53	1	0.565**	0.645**	0.241	0.306*	−0.119	−0.021	0.015
Relatedness frustration	54	54	54	54	53	53	54	1	0.624**	0.351*	0.335*	0.271*	0.239*	−0.037
Competence frustration	54	54	54	54	53	53	54	54	1	0.284*	0.348*	−0.022	−0.154	−0.086
SRQ-A														
External regulation	53	53	53	53	52	52	53	53	53	1	0.651**	0.579**	0.119	0.090
Introjected regulation	53	53	53	53	52	52	53	53	53	53	1	0.543**	0.309*	0.312*
Identified regulation	53	53	53	53	52	52	53	53	53	53	53	1	0.443**	0.454**
Intrinsic motivation	53	53	53	53	52	52	53	53	53	53	53	53	1	0.300*
AES	54	54	54	53	52	52	53	53	53	52	52	52	52	1

Listed below the diagonal are sample sizes

**Correlation is significant at the 0.01 level (two-tailed)

*Correlation is significant at the 0.05 level (two-tailed)

Table 5 Forward step-wise regression results for other constructs predicting SDI:SR overall score

Model	Predictor(s)	*B*	SE	R^2	Adjusted R^2	$\triangle R^2$	$\triangle F$	df
1	Related satisfaction	0.422***	0.088	0.318	0.304	0.318	22.824	(1, 49)
2	Related satisfaction	0.297***	0.098	0.396	0.370	0.078	6.176	(1, 48)
	AES	0.215***	0.086					

***$p < 0.001$

Further substantiating the need for ongoing research on the relationships specified in Fig. 1 and possible implications for interventions and supports for adolescents are the findings of the exploratory regression analysis that suggested that Relatedness Satisfaction and Agentic Engagement predicted overall self-determination in adolescents with disabilities. It is unclear why satisfaction of other basic psychological needs (i.e., autonomy and competence) did not predict self-determination. However, the findings preliminarily suggest that (1) feeling supported to initiate action in one's environment and communicate one's wants and needs, and (2) feeling satisfied in one's relations to others, predicts self-determination outcomes, as defined by the Causal Agency Theory. The lack of prediction by the motivational constructs may relate to higher levels of extrinsic regulation than intrinsic motivation reported by adolescents with disabilities. Perhaps with more experiences with agentic engagement, students would also come to have higher levels of intrinsic motivation, as found in other research suggesting a reciprocal relationship among these constructs over time (Jang et al. 2012). Further research is needed on the impact of strategies for foster feelings of autonomy and competence in environments for adolescents with disabilities, and if such interventions lead to enhance need satisfaction and self-determination. Further research is also needed that more systematically tests these relations under varying conditions to determine the environmental factors and intervention characteristics that enhance self-determination and other valued outcomes.

Limitations and Future Research Directions

All of the interpretations of the findings are preliminary and highlight the need for future research. In interpreting the findings, the limitations of the present study must be considered. The sample consisted only of students with disabilities being educated in a private school for students who needed specific supports for success. As such, the experiences of these students may differ from students with disabilities educated in other settings and the implications for inclusive settings where students with and without disabilities are educated together need further research and consideration. The current analysis used a forward step-wise regression approach in which predictors are evaluated based on statistical decisions due to the exploratory nature of our research questions. Future research now has a baseline to use in future research examining the relationships among the constructs. Further, although the sample size was small, limiting the analyses that could be undertaken, future research can benefit from these findings by utilizing these results to inform an a priori power analysis. Despite these limitations, the findings highlight the role of constructs from positive psychology in the lives of students with and without disabilities and the need for more research that includes students with disabilities and explores their experiences alongside their peers without disabilities in developing causal agency.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethics Statement All procedures undertaken in this study were approved in advance by the Institutional Review Board (IRB) of the University of Kansas.

Informed Consent IRB approved informed consent and assent procedures were followed for all participants in this study.

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References

Balcazar, F. E., Taylor-Ritzler, T., Dimpfl, S., Portillo-Peña, N., Guzman, A., Schiff, R., & Murvay, M. (2012). Improving the transition outcomes of low-income minority youth with disabilities. *Exceptionality, 20*, 114–132. https://doi.org/10.1080/09362835.2012.670599.

Blackorby, J., & Wagner, M. (1996). Longitudinal postschool outcomes of youth with disabilities: findings from the National Longitudinal Transition Study. *Exceptional Children, 62*, 399–413.

Chang, R., Durham, J., & Little, T. D. (in press). Enhancing students' motivation with autonomy-supportive classrooms. In M. L. Wehmeyer, K. A. Shogren, T. D. Little, & S. J. Lopez (Eds.), *Handbook on the development of self-determination*. New York, NY: Springer.

Chen, B., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E. L., Van der Kaap-Deeder, J., et al. (2015). Basic psychological need satisfaction, need frustration, and need strength across four cultures. *Motivation and Emotion, 39*, 216–236. https://doi.org/10.1007/s11031-014-9450-1.

Cordeiro, P., Paixão, P., Lens, W., Lacante, M., & Sheldon, K. (2016). Factor structure and dimensionality of the balanced measure of psychological needs among portuguese high school students. Relations to well-being and ill-being. *Learning and Individual Differences, 47*, 51–60. https://doi.org/10.1016/j.lindif.2015.12.010.

De Naeghel, J., Valcke, M., De Meyer, I., Warlop, N., van Braak, J., & Van Keer, H. (2014). The role of teacher behavior in adolescents' intrinsic reading motivation. *Reading and Writing, 27*(9), 1547–1565.

Deci, E. L. (1980). *The psychology of self-determination*. Lexington, MA: Lexington Books.

Deci, E. L. (1992). The relation of interest to the motivation of behavior: a self-determination theory perspective. In K. A. Renninger, A. Hidi, & A. Krapp (Eds.), *The role of interest in learning and development* (pp. 43–70). Hillsdale: Erlbaum.

Deci, E. L., & Ryan, R. M. (Eds.). (2002). *Handbook of self-determination research*. Rochester, NY: University of Rochester Press.

Deci, E. L., & Ryan, R. M. (2012). Motivation, personality, and development within embedded social contexts: an overview of Self-Determination Theory. In R. M. Ryan (Ed.), *The Oxford handbook of human motivation* (pp. 85–110). Oxford: Oxford University Press.

Deci, E. L., Hodges, R., Pierson, L., & Tomassone, J. (1992). Autonomy and competence as motivational factors in students with learning disabilities and emotional handicaps. *Journal of Learning Disabilities, 25*, 457–471.

Frielink, N., Schuengel, C., & Embregts, P. J. C. M. (2016). Psychometric properties of the Basic Psychological Need Satisfaction and Frustration Scale–Intellectual Disability (BPNSFS-ID). *European Journal of Psychological Assessment.* https://doi.org/10.1027/1015-5759/a000366.

Houghton, J., Bronicki, G. B., & Guess, D. (1987). Opportunities to express preferences and make choices among students with severe disabilities in classroom settings. *Journal of the Association for Persons with Severe Handicaps, 12*(1), 18–27.

Jang, H., Kim, E. J., & Reeve, J. (2012). Longitudinal test of self-determination theory's motivation mediation model in a naturally occurring classroom context. *Journal of Educational Psychology, 104*, 1175–1188. https://doi.org/10.1037/a0028089.

Little, T. D. (2013). *Longitudinal structural equation modeling*. New York: Guilford Press.

Little, T. D., Snyder, C. R., & Wehmeyer, M. L. (2006). The agentic self: on the nature and origins of personal agency across the lifespan. In D. Mroczek & T. D. Little (Eds.), *The hanbook of personality development* (pp. 61–79). Mahwah: Lawrence Erlbaum and Associates.

Niemiec, C. P., & Ryan, R. M. (2009). Autonomy, competence, and relatedness in the classroom: applying self-determination theory to educational practice. *Theory and Research in Education, 7*, 133–144. https://doi.org/10.1177/1477878509104318.

Nishimura, T., & Suzuki, T. (2016). Basic psychological need satisfaction and frustration in Japan: controlling for the big five personality traits. *Japanese Psychological Research.* https://doi.org/10.1111/jpr.12131.

Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.

Raykov, T., & Marcoulides, G. A. (2011). *Introduction to psychometric theory*. Routledge.

Reeve, J. (2002a). Self-determination theory applied to educational settings. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of self-determination research* (pp. 183–203). Rochester, NY: University of Rochester Press.

Reeve, J. (2002b). Self-determination theory applied to educational settings. In *Handbook of self-determination research.* (pp. 183–203): University of Rochester Press, Rochester, NY.

Reeve, J. (2013). How students create motivationally supportive learning environments for themselves: the concept of agentic engagement. *Journal of Educational Psychology, 105*, 579–595.

Reeve, J., & Lee, W. (2014). Students' classroom engagement produces longitudinal changes in classroom motivation. *Journal of Educational Psychology, 106*, 527–540.

Reeve, J., Jang, H., Carrell, D., Jeon, S., & Barch, J. (2004). Enhancing student's engagement by increasing teachers' autonomy support. *Motivation and Emotion, 28*, 147–169.

Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: examining reasons for acting in two domains. *Journal of Personality and Social Psychology, 57*, 749–761.

Ryan, R. M., & Deci, E. L. (2011). A self-determination theory perspective on social, institutional, cultural, and economic supports for autonomy and their importance for well-being. In V. I. Chirkov, R. M. Ryan, & K. M. Sheldon (Eds.), *Human autonomy in cross-cultural context*. New York: Springer.

Shogren, K. A., & Wehmeyer, M. L. (2016). *Relationship between basic psychological needs, motivation, causal action, and self-determination*. Lawrence: Kansas University Center on Developmental Disabilities.

Shogren, K. A., & Wehmeyer, M. L. (2017). *Self-Determination Inventory: student-report*. Lawrence: Kansas University Center on Developmental Disabilities.

Shogren, K. A., Kennedy, W., Dowsett, C., & Little, T. D. (2014a). Autonomy, psychological empowerment, and self-realization: exploring data on self-determination from NLTS2. *Exceptional Children, 80*, 221–235. https://doi.org/10.1177/001440291408000206.

Shogren, K. A., Wehmeyer, M. L., Palmer, S. B., Forber-Pratt, A., Little, T. J., & Lopez, S. J. (2014b). *Self-Determination Inventory: student-report [pilot version]*. Lawrence: Kansas University Center on Developmental Disabilities.

Shogren, K. A., Wehmeyer, M. L., Palmer, S. B., Forber-Pratt, A. J., Little, T. J., & Lopez, S. J. (2015a). Causal agency theory: reconceptualizing a functional model of self-determination. *Education and Training in Autism and Developmental Disabilities, 50*, 251–263.

Shogren, K. A., Wehmeyer, M. L., Palmer, S. B., Rifenbark, G. G., & Little, T. D. (2015b). Relationships between self-determination and postschool outcomes for youth with disabilities. *Journal of Special Education, 53*, 30–41. https://doi.org/10.1177/0022466913489733.

Shogren, K. A., Wehmeyer, M. L., Palmer, S. B., Forber-Pratt, A. J., Little, T. J., & Seo, H. (2017). Preliminary validity and reliability of scores on the Self-Determination Inventory: student report version. *Career Development and Transition for Exceptional Individuals, 40*, 92–103. https://doi.org/10.1177/2165143415594335.

Vansteenkiste, M., & Ryan, R. M. (2013). On psychological growth and vulnerability: basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration, 23*(3), 263–280. https://doi.org/10.1037/a0032359.

Vansteenkiste, M., Sierens, E., Goossens, L., Soenens, B., Dochy, F., Mouratidis, A., et al. (2012). Identifying configurations of perceived teacher autonomy support and structure: associations with self-regulated learning, motivation and problem behavior. *Learning and Instruction, 22*, 431–439. https://doi.org/10.1016/j.learninstruc.2012.04.002.

Ward, M. J. (2005). An historical perspective of self-determination in special education: accomplishments and challenges. *Research and Practice for Persons with Severe Disabilities, 30*, 108–112.

Wehmeyer, M. L. (1992). Self-determination and the education of students with mental retardation. *Education and Training in Mental Retardation, 27*(4), 302–314.

Wehmeyer, M. L. (1999). A functional model of self-determination: describing development and implementing instruction. *Focus on Autism and Other Developmental Disabilities, 14*, 53–61.

Wehmeyer, M. L. (2003). A functional theory of self-determination: model overview. In M. L. Wehmeyer, B. Abery, D. E. Mithaug, & R. Stancliffe (Eds.), *Theory in self-determination: foundations for educational practice* (pp. 182–201). Springfield: Charles C. Thomas Publishing Company.

Wehmeyer, M. L., & Shogren, K. A. (2017a). Applications of the self-determination construct to disability. In M. L. Wehmeyer, K. A. Shogren, T. D. Little, & S. J. Lopez (Eds.), *Handbook on the development of self-determination*. New York: Springer.

Wehmeyer, M. L., & Shogren, K. A. (2017b). The development of self-determination during adolescence. In M. L. Wehmeyer, K. A. Shogren, T. D. Little, & S. J. Lopez (Eds.), *Handbook on the development of self-determination*. New York: Springer.

Wehmeyer, M. L., Palmer, S. B., Agran, M., Mithaug, D. E., & Martin, J. E. (2000). Promoting causal agency: the self-determined learning model of instruction. *Exceptional Children, 66*, 439–453.

Wehmeyer, M. L., Shogren, K. A., Little, T. D., & Lopez, S. J. (Eds.). (2017). *Handbook on the development of self-determination*. New York: Springer.