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Rasch calibration of physical activity self-efficacy and social support scale for persons with intellectual disabilities

Miyoung Lee [a,*], Jana J. Peterson [b], Alicia Dixon [a]

[a] Oregon State University, United States
[b] Oregon Health & Science University, United States

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ABSTRACT

The purpose of this study was to investigate the construct validity of the Self-Efficacy/Social Support for Activity for persons with Intellectual Disability (SE/SS-AID) scales developed by Peterson, Peterson, Lowe, & Nothwehr (2009). A total of 146 participants with intellectual disabilities completed 6 self-efficacy (SE) items and 18 social support (SS) items. After applying the Rasch rating model, all SE items and 17 SS items fit the model and measured a single-construct. Thus, it was able to determine the item difficulty and person's level of SE and SS for physical activity by calculated logit scores. No items showed evidence for differential functioning by the level of intellectual disability. Model fit of SS subscales (e.g., staff, family, and peer) showed good-fit as well. In conclusion, SE and SS scales for physical activity can be measured more accurately for persons with intellectual disabilities by using the modified scales validated in this study.

1. Introduction

The life span of persons with intellectual disabilities (ID) has increased in recent years, and is now comparable to the general population. Aging populations with ID are now also developing chronic illnesses, such as cardiovascular disease, diabetes, heart disease, and cancer, similar to general population. Fortunately, many of these chronic diseases can be prevented through participation in physical activity and maintaining a healthy lifestyle (Bigby, 2004; Bittles et al., 2002; Fisher & Ketti, 2005).

According to a literature review, persons with ID do not meet the physical activity guidelines or engaged in sufficient amounts of physical activity to receive any health benefits (Stanish, Temple, & Frey, 2006). For example, in one study (Peterson, Janz, & Lowe, 2008), only 15% of persons with ID out of 133 adults achieved 10,000 steps per day, which is a cut-off point of the physical activity (PA) in healthy adults (Tudor-Locke & Bassett, 2004). In another study of health characteristics of adults with ID ($n = 1371$), the sample was characterized by low rates of exercise and frequent obesity, with over half of the participants classified as obese according to the body mass index (Janicki et al., 2002). Therefore, it is essential to investigate how to change physical inactivity behavior to active behavior for this population.

* Corresponding author at: Physical Activity and Disability Laboratory, Department of Nutrition and Exercise Sciences, Oregon State University, 103 Women's Building, Corvallis, OR 97331, United States. Tel.: +1 541 737 4649; fax: +1 541 737 6613.
E-mail address: miyoung.lee@oregonstate.edu (M. Lee).

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The social cognitive theory (Bandura, 1989) has been used to explain physical activity behavior through interactions of psychological and environmental factors, such as self-efficacy and social support, respectively (Marcus et al., 2006; Sallis, Grossman, Pinski, Patterson, & Nader, 1987). A few studies have utilized the social cognitive theory (SCT) to explain why individuals with ID are not participating in physical activities to improve healthy lifestyles. According to these few studies (Frey, Buchanan, & Rosser Sandt, 2005; Heller, Hsieh, & Rimmer, 2004; Temple, 2009), participating in a physical activity program can increase self-efficacy through supports modeling behavior performance, offering encouragement, and providing transportation to physical activity programming for persons with ID. Generalization of the study results, nevertheless, has been constrained due to the lack of construct-related validity evidence of self-efficacy measures employed for those studies. Frequently, PA related measures are employed that were developed for the general population, but have not been validated to the persons with ID.

Recently, Peterson, Peterson, Lowe, and Nothwehr (2009) have developed self-efficacy (SE) and social support (SS) scales specifically for persons with ID based on classical test theory (CTT), called the Self-Efficacy/Social Support for Activity for persons with Intellectual Disability (SE/SS-AID), which employs correlational analysis using a total score of items (Jago et al., 2009). The developed SE scale examines the feelings of physical activity confidence and the SS scale measures perceptions of the social environment for participation in physical activity. From the study, construct validity evidence for the scales was provided through confirmatory factor analysis (CFA) and internal consistency of the scale items.

Although CTT has been frequently used to examine construct validity of SE and SS scales utilized in the general population (Marcus, Selby, Niaura, & Rossi, 1992; McAuley, Mihalko, & Bane, 1997; Sallis et al., 1987), there are several weaknesses of this method for examining construct validity. First, most SE and SS questionnaires employ Likert-style scales, which is an ordinal scale. These scales are not technically additive because the distances between points (categories; e.g., agree and disagree) of the scale are inconsistent and subjective (Ostir et al., 2006; Zhu & Cole, 1996).

Additionally problematic is the use of total score to determine the respondent's abilities (e.g., competency of the physical education teacher) or positions (e.g., percentile of physical fitness) in the groups (Anshel, Weatherby, Kang, & Watson, 2009). A concern related to employing the total score is that it shows ceiling or floor effects depending on the study samples recruited (e.g., very low or high competent groups) despite applying the same scale. Also, the individual item's function is buried by the total score even though each item includes unique meaning and difficulty. For instance, even though a PA barrier scale is measuring one construct, one item examines the psychological barrier (e.g., lack of motivation) and another item measures the environmental barrier (e.g., lack of transportation). Furthermore, respondents could perceive that "lack of motivation" is more severe barrier than "lack of transportation" (Kang, Zhu, Ragan, & Frogley, 2007). Thus, the uniqueness and difficulty of each item can be barely scrutinized in CTT using the total score.

Advanced Rasch modeling, which is similar to the one-parameter Item Response Theory (IRT), not only overcomes the challenges of CTT, but also provides additional benefits. Since the Rasch model employs the logarithmic transformation to calculate log-odds (logit) of each item and each person, the ordinal scale items (in this case, SE and SS items) are converted into an interval scale such as negative to positive values similar to the *z*-score (Hart & Wright, 2002; Zhu & Cole, 1996).

If the developed scales accurately measure the constructs of SE and SS, a wide range of respondent SE and SS from very low to high levels should be able to be determined (Jago et al., 2009; Thomas, Shuford, Duke, & Cipriani, 2007). Fortunately, the Rasch model provides the levels of SE and SS for persons with ID (called a person's ability), and also the easiness/difficulty level of the item endorsement (item difficulty) can be examined by the logit score. The calculated logits of person's ability are independent from the item difficulty and Rasch item-person-map displays the range of item difficulty and person ability on a common scale so it can be compared at a glance (Linacre, 2007). In the SE and SS scales (Peterson et al., 2009), the item difficulty ranges from "easy to endorse (high SE or SS)" to "hard to endorse (low SE or SS)." In addition, low or high logits of the person ability takes into account "person's low or high SE and SS levels." Therefore, the person who perceives higher SE or SS has higher possibility to endorse more difficult items.

Furthermore, log transformation allows the data set to be linear and unidimensional because the accuracy index (e.g., infit and outfit) reports the distance of the data points from linearity, then examines the observed model fit with respect to the expected model. If any item does not fit the model, the item does not measure the uni-construct and then it should be eliminated from the scale. In consequence, the final scale can measure a single-construct, such as SE or SS (Bond & Fox, 2007; Linacre, 2007).

Another advantage of the Rasch model is that it is able to detect items that are biased toward specific groups, such as different cultural, language, or disability groups. This method is called differential item functioning (DIF) and has been successfully applied to the development of a variety of new health measurement scales, including physical activity questionnaires and physical impairment scales (Facon & Nuchadee, 2009b; Hart, Deutscher, Crane, & Wang, 2009; Lai, Cook, Stone, Beaumont, & Cella, 2009; Shea, Tennant, & Pallant, 2009). For persons with ID, some abstract words of physical activity-related questionnaires (e.g., *"regular"* or "*attitude*" toward physical activity) may be biased to the higher level of intellectual function, and DIF can identify these biases. When an item functions differently in certain groups, the item reduces the validity of the measure for that construct. Therefore, differentially functioning items in the specific group should be removed from the scale to secure the construct validity.

Although Rasch model has been frequently applied in the development of valid health-related self-report measures, it has been rarely employed to validate questionnaires measuring physical activity-related constructs, either in the general population or for persons with disabilities. The purpose of this study, therefore, was to investigate the construct-related validity evidence of the physical activity self-efficacy and social support scales for persons with intellectual disabilities utilizing the Rasch measurement model. Specifically, this study examined whether: (1) each scale is measuring a unidimensional construct, (2) the scale items show evidence of bias between levels of intellectual disability, (3) easy and difficult endorsement of SE and SS items (item difficulty) varies large enough to examine the variability of the respondent's SE and SS level (person's ability), and (4) social supports are different in subgroups (e.g., family, staff, and peer).

2. Methods

2.1. Participants

The data set was used previously in a study that investigated the construct-related validity evidence of the SE and SS scales by applying CFA methods. Detailed study methods are described elsewhere (Peterson et al., 2009). A total of 146 participants with ID were included in the final Rasch analysis after deleting any case with missing data (e.g., missing the demographic information). Age, gender, type of condition associated with intellectual disability, and level of intellectual impairment of the subgroups were treated as independent variables in this study. Detail demographic information is described in Table 1.

Participants were recruited from 11 agencies in the Midwest. Intellectual impairment level of the participants (mild and moderate) was defined by intellectual quotient (IQ). For individuals that did not have a current IQ on record, the agency reported whether their classification was mild or moderate intellectual disability in their agency records, see Peterson et al. (2009) for more information about definition and level of ID.

2.2. Measures and data collection

2.2.1. Measures

Scales of self-efficacy and social support for PA participation: the SE/SS-AID scales were developed to measure the effect of these correlates on physical activity participation for those with ID (Peterson et al., 2008b). The self-efficacy (SE) scale is composed of six questions with response options of "no, maybe, and yes." The social support (SS) scales are separated into subcategories related to family, staff, and peer. The total 18 social support scale items include seven questions in the family scale, six questions in the staff scale, and five questions in the peer scale. These scales have response categories of "no, yes-sometimes, and yes-a lot."

CFA was used to provide construct validity evidence for the SE and SS scales. According to the accuracy indices, such as Chi-square, the goodness-of-fit index (GFI), and the comparative fit index (CFI), all met criteria for good-fit, indicating that

Table 1
Demographic information of the participants.

Characteristics	*N*	%
Age[a]		
18–29	52	36
30–39	29	20
40–49	38	26
50 or over	27	18
Gender		
Male	78	53
Female	68	47
Diagnosis[b]		
Down	24	17
MR primary diagnosis	95	66
Other	26	18
Impairment level[c]		
Mild	82	56
Moderate	42	29
Unknown	22	15
Total	146	100

[a] Age = 37.34 ± 12.07 years.
[b] Diagnosis = type of condition associated with intellectual disability impairment.
[c] Level = level of intellectual impairment of the subgroups.

the scales fit the construct model well. The internal consistency reliability was determined by Cronbach alpha, with values of .70 to .74, and intraclass coefficient (ICC), which ranged from .76 to .79.

2.2.2. Procedures

The measure was administered by the second author (Peterson) through face-to-face interviews. The median length of time for the interviews was 31 min (range of 17–67 min). Before beginning that interview process, each participant signed an informed consent approved by the university institutional review board.

2.3. Rasch calibration

The Rasch rating scale model was employed because SE and SS scales for persons with ID used a three-point Likert-type scale. Four phases of Rasch calibration were applied to examine: (1) unidimensionality, (2) differential item functioning, (3) easiness/difficulty levels of the item endorsement and the person's SE and SS level, and (4) the level of SS in subscales of SS using three-many-facet Rasch analysis.

2.3.1. Unidimensionality

Items of the valid scale should measure a single-construct. If the items misfit the expected model, it could measure multiple domains composed of a multidimensional construct. The unidimensionality of the scale can be determined by infit and outfit (mean square) using Chi-square fit statistics. If the values of infit and outfit are 1, the observed scores perfectly fit the expected model. If the values of fit statistics, however, are lower or larger than the criteria, the observed score can over-fit or under-fit the predicted model, respectively (Bond & Fox, 2007). The frequently applied criteria of the accuracy index, 0.6–1.4, were applied in this study (Fitzpatrick, Norquist, Dawson, & Jenkinson, 2003; Liang et al., 2009). When misfits of the items are found, Rasch analysis should be re-applied after removing misfit items. If a deleted item affects the accuracy of the scale, the error rate of the model estimates should be reduced after eliminating the misfit item (Hart & Wright, 2002).

2.3.2. Differential item functioning (DIF)

The influence of intellectual level (mild vs. moderate) to endorse the items of SE and SS scale was examined utilizing DIF because any item could be systematically biased to one intellectual impairment level group (Facon & Nuchadee, 2009a). In this study, uniform DIF was applied to examine the variation between the two intellectual impairment groups (main effect). Non-uniform DIF examines the interaction effect, such as age, gender, and type of ID (da Rocha, Power, Bushnell, & Fleck, 2009; Elhan, Oztuna, Kutlay, Kucukdeveci, & Tennant, 2008), but it was not considered in this study because bias according to higher or lower intellectual level is the largest concern in developing new scales for this population.

Even though applying the criteria of *t*-statistics has been debated, it is relatively frequently employed to determine DIF. Thus, the *t*-statistic with calculated logit scores was applied using WINSTEPS 3.643. The alpha (α) was set at .01 after applying Bonferroni correction technique due to the multiple comparisons of each item (de Morton, Keating, & Davidson, 2008; Liang et al., 2009; Woodbury et al., 2008; Wuang & Su, 2009).

2.3.3. Item difficulty and person ability

With only well-fit items selected, SE and SS item difficulty to endorse and person's level of SE and SS were calculated using the log-odds scale (logits), which is an interval scale. As described in the introduction, the logits of item difficulty and the level of person's SE and SS are independent and can be compared on a common scale (Fig. 1 as an example). If the logit of the person's ability and item difficulty is the same (e.g., logit = .30 for each), there is 50% chance that the person endorses the specific item. If A person's ability (logit = .49) is lower than A item difficulty (logit = 1.5), there is less chance to endorse the item (i.e., SE-yes and SS-yes a lot) by the A person. In addition, if the difficulty of a SE item is 2.4 (logit), it is twice harder to respond "yes" to participate in PA than the logit of an item is 1.2. Also, a person who has 4.0 logit in SE scale can be three times more confident to participate in PA than the person who shows −2.0 logit of SE.

2.3.4. Many-facet Rasch model

A further advantage of the Rasch model is to allow the examination of the impact of subgroups or subscales while employing many-facets. Because separated logit scores by subcategories can be calculated, those values can be compared with a common measurement unit (Linacre, 1993; Sudweeks, Reeve, & Bradshaw, 2004). Many-facet Rasch model has been successfully applied in health-related fields. For example, it was employed to examine the variability of the different occasions and decisions of multiple judges in performance assessments (Schumacher, 1999; Smith & Kulikowich, 2004; Zhu, Ennis, & Chen, 1998), and to determine differences in gross motor skills in children among subgroups (e.g., age, disability, gender, and race) and subscales (e.g., locomotor and objective control skills) (Zhu & Cole, 1996). In this study, the SS scale includes three subscales: family, staff, and peers. Therefore,

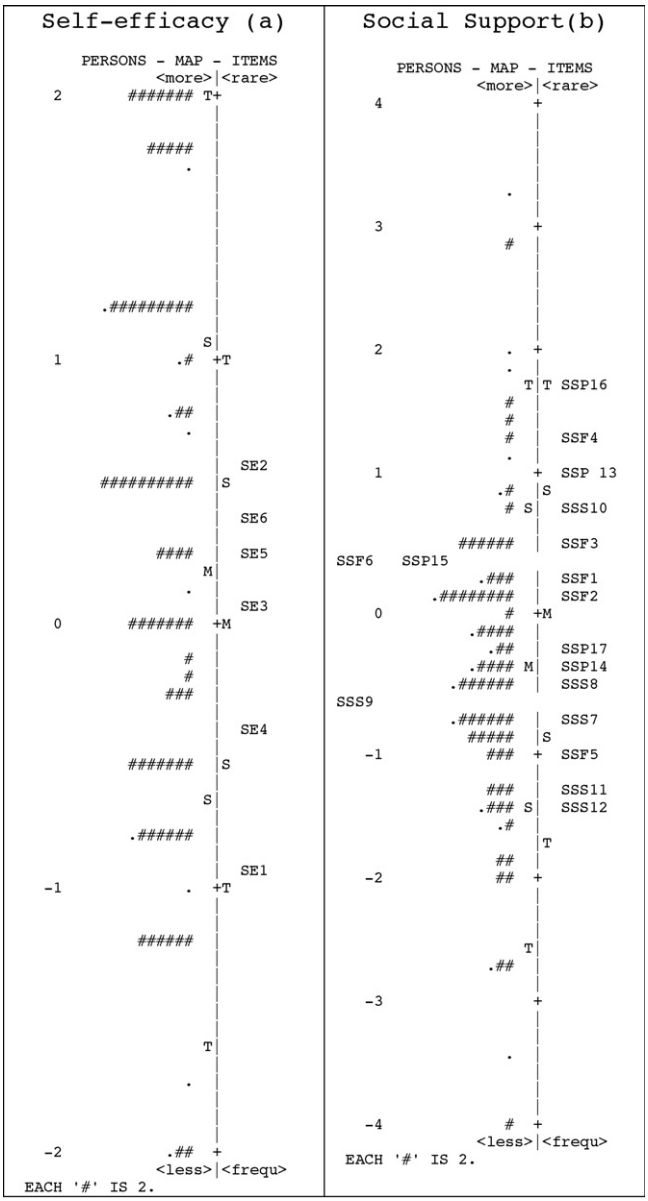

Fig. 1. Item-person map of self-efficacy (a) and social support (b) scales. *Note*. SE: self-efficacy, SSP: social support from peers, SSF: social support from family, SSS: social support from staff.

three-facet Rasch analysis including item, person, and SS subscales was applied to scrutinize the impact of SS by the subgroups.

For descriptive analysis, SPSS 17 (SPSS Inc., IL) was applied. Rasch analyses were conducted using WINSTEPS Version 3.643 (Linacre, 2007) and FACETS Version 3.03 (Linacre, 1996).

3. Results

Participant demographic information is summarized in Table 1. The Rasch calibration results are as follows.

3.1. Unidimensionality and Model Fit

In the initial Rasch analysis to check the unidimensionality of the SE and SS scales, the infit and outfit of the six SE items and 18 SS items were examined all at once; however, it showed many misfits from infit (3 items of SE) and outfit (7 items of

Table 2
Item difficulty and model fit indices of self-efficacy and social support scales.

Item#	Logits	SE	Infit	Outfit	Sub#	Do you think that you can
Self-efficacy						
2	0.58	0.12	0.98	0.96	SE2	Do physical activities even when you are very busy?
6	0.40	0.12	0.97	0.88	SE6	Do physical activities when you feel lazy?
5	0.28	0.12	1.01	1.00	SE5	Do physical activities on days when you are tired or don't have much energy?
3	0.05	0.12	0.99	0.97	SE3	Do physical activities even when you are feeling sad or depressed?
4	−0.41	0.13	1.02	1.06	SE4	Do physical activities even after a long, hard day at work?
1	−0.91	0.14	1.02	1.22	SE1	Make time for physical activities almost every day?
Item#	Logits	SE	Infit	Outfit	Sub#	Does your
Social support						
16	1.66	0.18	1.23	1.15	SSP4	Peers: show you how to do physical activities?
4	1.32	0.16	1.20	1.06	SSF4	Family: show you how to do physical activities?
13	1.01	0.15	1.12	0.89	SSP1	Peers: remind you to do physical activities?
10	0.67	0.14	1.12	0.99	SSS4	Staff: show you how to do physical activities?
15	0.48	0.13	1.06	0.98	SSP3	Peers: ask you to do physical activities with them, or is it ever their idea?
6	0.41	0.13	1.09	1.17	SSF6	Family: drive you somewhere to do physical activities when you need them to?
3	0.40	0.13	0.95	0.98	SSF3	Family: plan physical activities when you spend time with them?
1	0.24	0.12	1.17	1.21	SSF1	Family: remind you to do physical activities?
2	0.14	0.12	1.10	1.35	SSF2	Family: do physical activities with you?
17	−0.33	0.12	0.98	0.92	SSP5	Peers: tell you that you are good at physical activities?
14	−0.47	0.12	0.92	0.90	SSP2	Peers: do physical activities with you?
9	−0.56	0.12	0.88	0.86	SSS3	Staff: plan physical activities when you spend time with them?
8	−0.60	0.12	0.85	0.93	SSS2	Staff: do physical activities with you?
7	−0.69	0.12	1.02	1.08	SSS1	Staff: remind you to do physical activities?
5	−1.06	0.13	1.02	0.96	SSF5	Family: tell you that you are good at physical activities?
11	−1.24	0.13	0.88	0.80	SSS5	Staff: tell you that you are good at physical activities?
12	−1.39	0.13	0.78	0.93	SSS6	Staff: drive you somewhere to do physical activities when you need them to?

SE = self-efficacy, SSP = social support from peers, SSF = social support from family, SSS = social support from staff.

SS). It means SE and SS scale were not a unidimensional construct, but multidimensional. Therefore, Rasch analysis was separately applied for SE and SS scales.

All six items of SE scale fit the construct model well between 0.6 and 1.4. Among the 18 items of SS, 17 items showed good-fit, but one of family related SS item [Does anyone in your family pay for you to do physical activities somewhere or buy you things that you need to do physical activities?], showed misfit, in which infit was 1.30 and outfit was 1.44. Therefore, the item was deleted from the scale, then Rasch analysis was re-applied. The final 17 items of SS fit the model well. Infit and outfit of the items in each construct are summarized in Table 2 and the modified new scales are presented in Appendix A.

3.2. Differential item functioning

To examine the DIF of the scales by the intellectual impairment groups, only 124 individual's responses were included for the final analysis after eliminating the "unknown" group. None of items in either SE or SS scales showed statistically significant DIF. In other words, no item was biased to a certain level of intellectual functioning (mild vs. moderate) with $p < .01$ after Bonferroni correction.

3.3. Item difficulty and person ability

The difficulty of SE and SS items and person's SE and SS level are summarized in Table 2 and Fig. 1(a and b). Item difficulty for SE ranged from −.91 to .58 (logits), and for SS items was from −1.39 to 1.66. Item 2 of SE and item 16 of SS were the most difficult to endorse and item 1 of SE and item 12 of SS were the least difficult items. In other words, the most easily endorsed "yes" in the SE scale was item 1 [Can you make time for physical activities almost every day?], and "yes-a lot" in the SS scale was item 12 [Do staff drive you somewhere to do physical activities when you need them to?]. In addition, the level of person's SE and SS was between −2.85 and 2.81 in SE and 4.67 and 3.33 in SS, which shows larger variability in perceived SS than in SE for PA.

3.4. Many-faceted Rasch results

The results of the three-facet Rasch analysis of SS scales are summarized in Table 3. All subscales demonstrated good-fit in both infit and outfit between 0.9 and 1.1, respectively. Among the three SS subscales, SS from staff showed the easiest (−.34) to obtain and peer's SS (.21) showed the most difficult to receive. This means that for SS to participate in PA, respondents endorsed "yes-a lot" for staff items more than other subgroup items.

Table 3
Logit scores and model fit indices of social support subscales.

Subscale	Logits	SE	Infit	Outfit
Peers	.21	0.06	1.0	1.0
Family	.13	0.05	1.1	1.1
Staffs	−.34	0.05	0.9	0.9

4. Discussion

Even though the self-efficacy and social supports based on SCT have been essential determinants to change physical activity behavior (Marcus et al., 2006), the investigation of the impact of these variables for persons with ID is limited due to the lack of the valid instruments available. Fortunately, Peterson et al. (2009) have recently developed the SE/SS-AID scales specifically for this population with construct validity evidence based on the CTT. In this study, further construct-related validity evidence was examined utilizing the Rasch model, which is an advanced and sophisticated theoretical model and additional psychometric properties were provided.

After applying Rasch rating model, all 6 SE items and 17 out of 18 items of SS scale were measuring a single-construct, respectively, but one SS item showed less relevance to the SS construct, which was a "payment by family" item. Even though "cost" related PA barrier was an important component for PA for the persons with ID in the study of Temple (2009), the specific item was less related to the construct of the SS scale developed by Peterson et al. (2009). While Peterson et al. (2009) was developing SS items, all subgroups (family, staff, and peers) included "payment" related questions; however, those items were eliminated from staff and peer subgroups for the final version due to lack of relevance to the construct or inconsistency of responses from the focus groups and a series of pilot studies. Likewise, it implies that the financial support could be irrelevant with the construct of perceived SS for persons with ID. From DIF analysis, surprisingly, there was no biased item on the specific level of intellectual impairment groups in both SE and SS scales. This result could provide scientific evidence whether a conceptual construct of PA SE and SS for individuals with ID can be measured fairly and accurately during self-report measures.

In Fig. 1, the item difficulty and person ability are compared on the common scale. In terms of accuracy of the estimation of the person's level of SE and SS using the developed scales, the SS scale can make a more accurate estimate. This was evidenced by the wider range of perceived SS levels were observed compared to SE levels; SS item difficulty was widely varied compared to SS item difficulty, except for a few participants with lower SS scores.

In addition, there was less variation of logit scores in SE and SS items than the logit score of person's ability. In detail, the SE and SS items could most accurately predict the person's endorsement to the SE and SS items when the person ability was within −.91 to .58 (logits) and −1.39 to 1.66, respectively (see Table 2 and Fig. 1) because the item difficulty scores varied between those values. In other words, if the person ability logits were lower and higher than the range of item difficulty logits, the estimated value of the person's SE and SS levels would most likely be less accurate. These findings were similar with other self-efficacy studies (Jago et al., 2009; Thomas et al., 2007; Watson, Baranowski, & Thompson, 2006). For example, Jago et al. (2009) developed PA and Sedentary Behavior Change SE Questionnaires for the general population. The range of item difficulty was between about −1.5 and 1.5, but the variability of person ability was much larger (e.g., 4.8; see Fig. 2 Jago et al., 2009). The authors pointed out that their estimation of the person's logit would be less accurate when the person's ability is higher or lower than 1.5 logit of the item difficulty. Consequently, it is recommended to develop more "easy" and "hard" items to estimate PA SE and SS more accurately for the persons with ID.

Another supporting example of the need for more items can be found from a PA barrier of persons with ID (Temple, 2009). In the current study, the item of [do physical activities even when you are very busy?] was the most difficult to endorse "yes" to participate in PA among six SE items. Based on Temple study (2009), "lack of time" was a less perceived barrier of PA for the participants with ID who were somewhat physically active or active. Instead, participant's health conditions or weather showed a higher restriction for PA for the respondents in Temple's study, in which those items were not included in the current scale. As a result, it can be inferred that more difficult SE items might be "weather" or "health condition" compared to "time" items (e.g., can do PA even when it is hot or cold outside). Note this is only a suggestion for future studies, because a single study (Temple, 2009) cannot be a representative of PA barriers in this population. To add new items and increase the range of item difficulties, more empirical evidence is needed.

Even though item difficulty of the SS scale showed a larger range (1.39–1.66) than SE scale, there is still a lower level of person's perceived SS than item difficulty (see Fig. 1b). Therefore, additional easier items to the SS scale are needed. In short, newly developed items could detect larger ranges of participant SE and SS levels, ultimately allowing the scales to detect larger changes in SE and SS in response to PA interventions.

Unlike general population SS scales (Chogahara, 1999; Sallis et al., 1987), the present study added staff items as a unique subscale for people with ID. From the many-facet Rasch analysis, it was revealed that participants could easily endorse "yes-a lot" and receive more PA support from staff (−.34) compared to other groups (Table 3). In fact, among the 17 SS items, five of the easiest items for SS were related to staff, except for item SSF5 from the family subscale [Does your family tell you

that you are good at physical activities?]. Interestingly, the items of [. . .show how to do physical activities] from each subscale (SSP4, SSF4, and SSS4) were most difficult to endorse regardless of the referent group. Peer supports were emphasized less than the other two groups, but "doing PA together" with peers was relatively easy to endorse compared to the other groups. Likewise, the Rasch model was able to investigate the functions of individual items and subscales rather than employing the total score, as well as compare person's SS levels on the common scale. In consequence, the Rasch rating model provided successful evidence of a unidimensional construct of SS, with 17 items and subscales by referent groups. With this evidence, researchers can employ all items together or use the subscales separately depending on particular study needs.

It is noted that there are limitations with both Rasch model and methods used in the previous study (Peterson et al., 2009). First, even though Rasch model provides useful information compared to traditional models (Bond & Fox, 2007), it may be difficult for the reader to interpret results because it is more conceptually complicated. Second, the relationship of the SE and SS scales to actual physical activity behavior measured by objective measures was not examined.

Third, the rating scale (e.g., never, sometimes, and a lot) can be a cause of irregular responses if the item categories are not well developed (Linacre, 1999). For example, the person's perception between the points, such as never to sometimes, could be inconsistent or not mutually exclusive. As a result, the distribution of the item choice can be skewed to certain categories (e.g., endorsing only never or a lot, but not sometimes), then the less selected category is meaningless. In this study, scrutiny of the accuracy of the categories was limited. While new health-related measurement scales were developed, "optimal categorization" could also be adopted. This has been successfully applied in other studies utilizing the Rasch rating model (Kornetti, Fritz, Chiu, Light, & Velozo, 2004; Pesudovs & Noble, 2005; Thomas et al., 2007; Zhu, Timm, & Ainsworth, 2001; Zhu, Updyke, & Lewandowski, 1997). In the future, the function of categories (e.g., never, yes-sometimes, and yes-a lot) should be investigated based on the Rasch model.

Fourth, even though the Rasch model provided construct-related validity evidence for the SE and SS scales, self-report methods fundamentally possess threats to internal validity (Montoye, Kemper, Saris, & Washburn, 1996; Welk, 2002) as mentioned in the previous article (Peterson et al., 2009). In the past, proxies have been utilized to assist individuals with ID during semi-structured interviews (Frey, Stanish, & Temple, 2008; Stanish & Draheim, 2005; Stanish & Frey, 2008; Stanish et al., 2006; Temple, Frey, & Stanish, 2006; Temple & Stanish, 2008, 2009) and there are concerns about proxy responses for subjective information (Lunsky & Benson, 1997; Schalock et al., 2002; Stancliffe, 2000). Therefore, it is critical to investigate the impact of proxies on the internal validity and measurement errors while subjective self-report measures are developed for the persons with ID.

5. Conclusions

Since the majority of adults with ID fall below the public health guidelines (Peterson et al., 2008b; Stanish et al., 2006) and are at risk for chronic diseases, physical activity research and evidence-based programs (Drum et al., 2009) to promote health for this population are of utmost importance. Researchers must determine why individuals with ID are not utilizing PA to improve health. Two determinants noted in research to be associated with PA behavior in this population are self-efficacy and social support (Heller et al., 2004; Peterson et al., 2009; Temple, 2009). In order to properly measure these determinants, valid and reliable measures are needed. This study examined the construct-related validity of previously establish SS and SE scales (Peterson et al., 2009) using the Rasch Model. With combined validity evidence provided through this study and Peterson et al. (2009), the Self-Efficacy/Social Support for Activity for persons with Intellectual Disability scales can be employed to examine how the relationship among these factors in this population. It is noted that continued cross-validation work is still needed, and easier or more difficult items of SE and SS should be developed for the scales. Determining the specific factors affecting PA in this population is a promising way to implement appropriate evidence-based programs that ultimately improve health and wellness for those with intellectual disabilities.

Conflict of interest

This study was not supported by any private companies, manufacturers, or outside organizations providing technical or equipment. Also, this study has not been submitted to any other journals.

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Appendix A

Modified Self-Efficacy/Social Support for Activity for persons with Intellectual Disability (SE/SS-AID) scales.

Self-efficacy for activity for persons with intellectual disabilities (SE-AID) scale	No	Maybe	Yes
1. Do you think that you can make time for physical activities almost every day?	☐	☐	☐
2. Do you think that you can do physical activities even when you are very busy?	☐	☐	☐
3. Do you think that you can do physical activities even when you are feeling sad or depressed?	☐	☐	☐
4. Do you think that you can do physical activities even after a long, hard day at work?	☐	☐	☐
5. Do you think that you can do physical activities on days when you are tired or don't have much energy?	☐	☐	☐
6. Do you think you can do physical activities when you feel lazy?	☐	☐	☐
Social support for activity for persons with intellectual disabilities (SS-AID): Family scale	**No**	**Yes-sometimes**	**Yes-a lot**
1. Does anyone in your family remind you to do physical activities?	☐	☐	☐
2. Does anyone in your family do physical activities with you?	☐	☐	☐
3. Does anyone in your family plan physical activities when you spend time with them?	☐	☐	☐
4. Does anyone in your family show you how to do physical activities?	☐	☐	☐
5. Does anyone in your family tell you that you are good at physical activities?	☐	☐	☐
6. Does anyone in your family drive you somewhere to do physical activities when you need them to?	☐	☐	☐
Social support for activity for persons with intellectual disabilities (SS-AID): Staff scale	**No**	**Yes-sometimes**	**Yes-a lot**
1. Does your staff remind you to do physical activities?	☐	☐	☐
2. Does your staff do physical activities with you?	☐	☐	☐
3. Does your staff plan physical activities when you spend time with them?	☐	☐	☐
4. Does your staff show you how to do physical activities?	☐	☐	☐
5. Does your staff tell you that you are good at physical activities?	☐	☐	☐
6. Does your staff drive you somewhere to do physical activities when you need them to?	☐	☐	☐
Social support for activity for persons with intellectual disabilities (SS-AID): Peer or Roommate scale	**No**	**Yes-sometimes**	**Yes-a lot**
1. Do any of your roommates [*or friends*] remind you to do physical activities?	☐	☐	☐
2. Do any of your roommates [*or friends*] do physical activities with you?	☐	☐	☐
3. Do any of your roommates [*or friends*] ask you to do physical activities with them, or is it ever their idea?	☐	☐	☐
4. Do any of your roommates [*or friends*] show you how to do physical activities?	☐	☐	☐
5. Do any of your roommates [*or friends*] tell you that you are good at physical activities?	☐	☐	☐

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