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一般論文

Mapping the Progression of Lingering Effects of Bullying Victimization: An Item Response Theory Approach

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Abstract

The present study developed and psychometrically evaluated the Perceived Changes in Well-Being Scale based on prior research to measure the lingering effects of bullying victimization among Japanese school students using Item Response Theory. Exploratory factor analysis identified a three-factor structure comprising physical symptoms, emotional distress, and psychosocial withdrawal. Bifactor modeling further revealed a dominant general factor alongside three specific factors, supporting the adequacy of unidimensional IRT estimation. The results of Graded Response Model indicated that physical symptoms emerged at relatively low levels of psychological harm, suggesting their potential as early indicators of victimization, whereas perceived deterioration in relationships with teachers and parents was only endorsed under conditions of severe victimization. These findings offer an empirically grounded account of the sequential ordering of lingering effects as bullying victimization severity increases.

Keywords : school bullying, perceived changes in well-being, lingering effects, item response theory

Introduction

Research spanning over three decades has documented a general downward trend in the overall prevalence of school bullying across many countries (Kennedy, 2019; Molcho et al., 2009). However, this aggregate picture conceals a more troubling pattern. Evidence from Europe and North America indicates that while infrequent victimization has declined, rates of severe and high-frequency bullying have remained persistently stable (Rigby & Smith, 2011; Bjereld et al., 2020). In

Japan, a trend analysis of 23,704 students from 5th to 9th grade conducted between 2017 and 2022 found that although overall bullying prevalence declined from 41.4% to 37.3%, incidents occurring more frequently showed no comparable reduction (Shu et al., 2024). Specifically, only infrequent cases (those occurring less than once a month) decreased significantly, while cases occurring more than once a month remained statistically unchanged. These findings suggest that reductions in overall bullying rates may primarily reflect the resolution of less severe cases, leaving a persistent

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and resistant core of chronic victimization undressed.

The persistence of high-frequency bullying is particularly concerning in light of accumulated evidence on the long-term psychological consequences of victimization. A dose-effect relationship has been consistently documented in the longitudinal literature: victims who are bullied more frequently, more severely, or over longer durations exhibit substantially worse outcomes in adulthood than those who experience only isolated incidents (Wolke & Lereya, 2015). A five-decade British birth cohort study found that frequent victims faced significantly elevated risks of depression, anxiety disorders, and suicidality at age 50, even after controlling for known confounders (Takizawa et al., 2014). Among Japanese samples, Mizutani and Amemiya (2015) similarly found that bullying victimization, particularly during the middle school period, exerted lasting effects on university students' well-being both directly and indirectly via self-esteem. Taken together, these findings suggest a critical implication for the epidemiological pattern: if high-frequency victimization is precisely the subgroup that resists decline over time, then the cases most likely to generate enduring psychological harm are also those least amenable to resolution under current intervention practices. Understanding the psychological consequences specific to sustained, high-frequency victimization therefore constitutes a pressing empirical priority.

Addressing this high-severity, persistent subgroup requires tools capable of capturing not merely the occurrence of psychological consequences, but their relative severity and sequential ordering. Yet existing measurement instruments present a significant obstacle. The majority of bullying consequence scales have been developed and evaluated using Classical Test Theory (CTT), which treats all items as equally weighted contrib-

utors to a total score and provides no information about the differential severity of the phenomena each item represents (Edelen & Reeve, 2007). As a result, these scales can document the presence of psychological outcomes but cannot answer a clinically and developmentally critical question: which symptoms emerge first, at lower levels of cumulative victimization exposure, and which only manifest at higher, more chronic levels? In Japan, Banzai (1995) documented that higher bullying distress was associated with more severe mental and physical health outcomes among university students, providing early evidence for a severity gradient among consequences; however, no instrument has been developed to formally map this gradient.

Item Response Theory (IRT) offers a principled solution to this limitation. Unlike CTT, IRT models the relationship between a respondent's level on the latent trait — in this case, the severity of psychological harm experienced following victimization — and their probability of endorsing each item on a scale. The item difficulty parameter, in particular, identifies the point on the latent trait continuum at which a given item provides maximum information — that is, the severity threshold at which a symptom becomes likely to be endorsed. When applied to a scale measuring the psychological effects of bullying, this parameter hierarchy can be interpreted not merely as a psychometric property, but as a substantive map of symptom progression: items with lower difficulty parameters represent consequences that emerge relatively early, while those with higher difficulty parameters represent consequences that are only manifest under conditions of severe or chronic exposure. This logic provides an empirically grounded basis for inferring the likely developmental ordering of psychological symptoms, directly addressing the gap identified above. Prior

IRT applications to bullying scales have validated this interpretive framework for behavioral scales (e.g., Breivik and Olweus, 2015); the present study extends it, for the first time in the Japanese context, to a scale of victimization consequences. In doing so, this study contributes a methodologically novel and practically relevant perspective to the literature on the long-term consequences of school bullying in Japan.

Method

Participants and Procedures

The sample was collected in X city with 15 primary schools and 6 junior high schools. After obtaining the formal consent of the research ethics committee from the Educational Department of Hokkaido University and the education board of X city, A total of 3,799 students (1,869 boys and 1,899 girls, 31 missing) were recruited in 2021.

Material

Bullying victimization. An eight-item victimization scale was conducted identical to Shu et al. (2024). Participants were asked, “In this school year, have you ever experienced the following things by someone in your school?” to report their experiences of victimization on a 5-point Likert scale. In this study, the Cronbach’s α was .78.

Perceived Changes in Well-Being Scale (PCWS). This scale was adjusted from the lasting influences of bullying victimization scale (Banzai, 1995). Initially, several items were removed due to their lack of discriminatory power. New items were then introduced, specifically targeting aspects of depressive affect and relationships with teachers and parents, leading to the creation of a twelve-item scale. The wording of these items was carefully revised to enhance comprehension among primary and secondary school

students. Participants were instructed to evaluate their perceived change in well-being by comparing their condition prior to experiencing victimization with their current well-being status across these items (e.g., “I feel tired more easily”), and to express their responses using a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree).

Data Analysis

Students who reported no victimization across all items of the bullying victimization scale were excluded, resulting in a final sample size of 1,407 students (761 boys, 633 girls, 13 unknown). First, Exploratory Factor Analysis (EFA) was performed to examine the underlying factor structure of the scale. Second, to verify the unidimensionality assumption required for IRT modeling, a bifactor solution was estimated to compute omega hierarchical (ω_h), Explained Common Variance (ECV), and the Percentage of Uncontaminated Correlations (PUC), alongside the ratio of the first to second eigenvalue from the polychoric correlation matrix. Finally, the Graded Response Model (GRM) was applied to estimate item discrimination and threshold parameters. The threshold parameters, reflecting the levels of the latent trait at which successive response categories become equally probable, were interpreted as indices of symptom severity, allowing for inferences regarding the developmental ordering of psychological consequences associated with bullying victimization. All analyses were performed using R, utilizing the “psych” (Revelle, 2021), “lavaan” (Rosseel, 2012) and “mirt” (Chalmers, 2012) packages.

Results

Exploratory Factor Analysis

Parallel analysis revealed a three-factor structure: physical symptoms, emotional distress, and

psychosocial withdrawal. The factor loadings for each item exceeded 0.4, and the commonality values for each item were all above 0.5, demonstrating the scale's strong validity. Furthermore, the Cronbach's alpha coefficients for these three fac-

tors were .76, .88, and .82, respectively, while the overall scale exhibited a Cronbach's alpha of .92, indicating robust internal consistency. For detailed information, refer to Table 1.

Table 1 *Results of the EFA for PCWS*

item	loadings	commonality
Physical Symptoms ($\alpha = 0.76$)		
I feel tired more easily	.57	0.737
I have difficulty sleeping well	.48	0.712
Emotional Distress ($\alpha = .88$)		
I feel lonely more frequently	.89	0.806
I feel sad more frequently	.86	0.749
I have difficulty interacting with others	.76	0.735
I am overly sensitive to others' attitudes	.66	0.728
I have lost confidence in myself	.63	0.616
Psychosocial Withdrawal ($\alpha = 0.82$)		
My relationship with my parents has worsened	.81	0.527
My relationship with my teachers has worsened	.77	0.757
I have lost motivation for studying and leisure activities	.72	0.559
I have fewer things to look forward to	.62	0.746
I have less interest in things around me	.54	0.748

Item Response Theory

Before conducted the IRT analysis, the unidimensionality of the scale was tested by CFA. The results showed that the model fit was not good enough ($\chi^2(54) = 565.491$, $p < .001$, CFI = .902, TLI = .881, RMSEA = .084, SRMR = .047), therefore a bifactor model was subsequently estimated to evaluate whether a dominant general factor underlies the scale sufficient to justify unidimensional IRT modeling. The ratio of the first to second eigenvalue was 6.20 ($\lambda_1 = 6.41$, $\lambda_2 = 1.03$), indicating a strongly dominant first factor and supporting the assumption of essential unidimensionality (Embretson & Reise, 2000). Furthermore, PUC = .682, which fell below the .80 threshold, suggesting that the three group factors in the bifactor model contribute non-neg-

ligible variance beyond the general factor. Under this condition, $\omega_h = .787$ and ECV = .735 both exceeded the tentative benchmarks of .70 and .60, respectively, proposed by Reise et al. (2013), supporting the essential unidimensionality of the scale for IRT analysis. Taken together, although the single-factor CFA model did not achieve conventional fit thresholds, the pattern of evidence collectively supports the appropriateness of proceeding with unidimensional GRM estimation. Finally, the GRM was fitted to the scale items to estimate item parameters, yielding acceptable fit ($\chi^2(30) = 189.443$, $p < .001$, CFI = .975, TLI = .965, RMSEA = .063, SRMR = .067), indicating that the GRM adequately represents the response data.

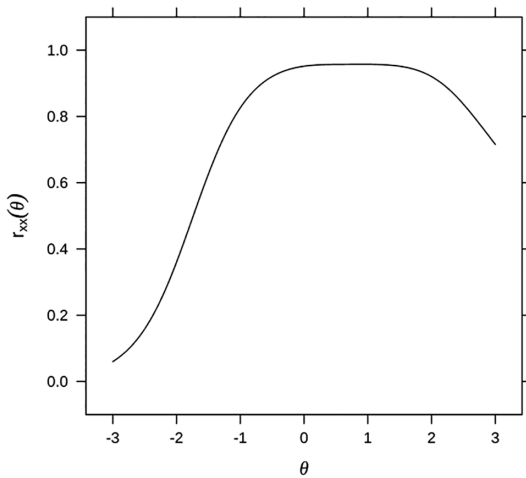


Figure 1 Conditional reliability of PCWS

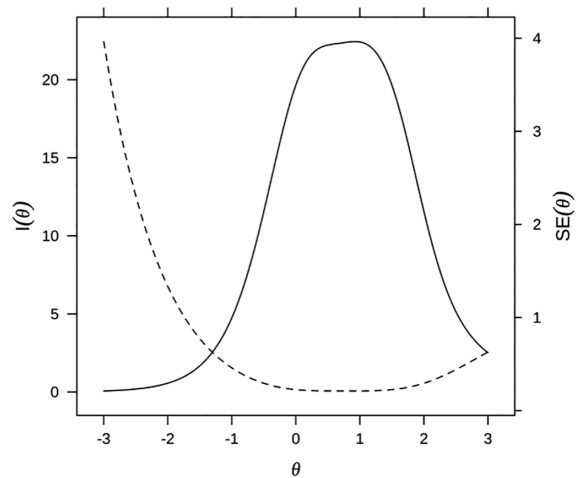


Figure 2 Test information curve of PCWS

Figure 1 displays the conditional reliability of the scale, illustrating that the scale's reliability is optimal for individuals with a latent trait level ranging from -1 to 2.5 . Furthermore, the test information curve, presented in Figure 2, reveals that the scale provides the most information for

individuals within a latent trait level of approximately -1 to 3 . The discrimination parameter estimates for all items fell between 1.59 and 3.04 , and all threshold parameters were organized in ascending order. The range for the lowest threshold parameters varied from -0.49 to 0.97 , while

Table 2 Item discrimination and threshold of PCWS

item	a	b1	b2	b3
I feel tired more easily	2.22	-0.49	0.20	1.11
I have difficulty sleeping well	2.47	0.01	0.81	1.52
I have lost confidence in myself	3.04	-0.24	0.39	1.13
I have difficulty interacting with others	2.89	-0.16	0.45	1.12
I am overly sensitive to others' attitudes	2.18	-0.49	0.19	1.02
My relationship with my parents has worsened	1.70	0.82	1.94	2.63
I feel lonely more frequently	2.71	0.00	0.63	1.27
I feel sad more frequently	2.70	-0.08	0.47	1.08
I have less interest in things around me	2.97	0.16	0.95	1.60
I have fewer things to look forward to	2.97	0.19	0.86	1.46
I have lost motivation for studying and leisure activities	2.79	0.12	0.85	1.50
My relationship with my teachers has worsened	1.59	0.97	2.44	3.16

Note. Item discrimination indicating the ability to differentiate between respondents with varying proficiency levels, the larger the discrimination value, the better the item separates respondents with different ability levels. Item thresholds representing the latent trait levels required to reach specific response probabilities; each threshold represents the level of bullying-related distress (θ) at which the probability of endorsing one response category surpasses that of the preceding one. For example, for the first item "feeling tired more easily," respondents reporting greater bullying-related distress (θ between 0.20 and 1.11) are more likely to select "Agree," whereas those with more severe distress ($\theta > 1.11$) are more likely to select "Strongly Agree."

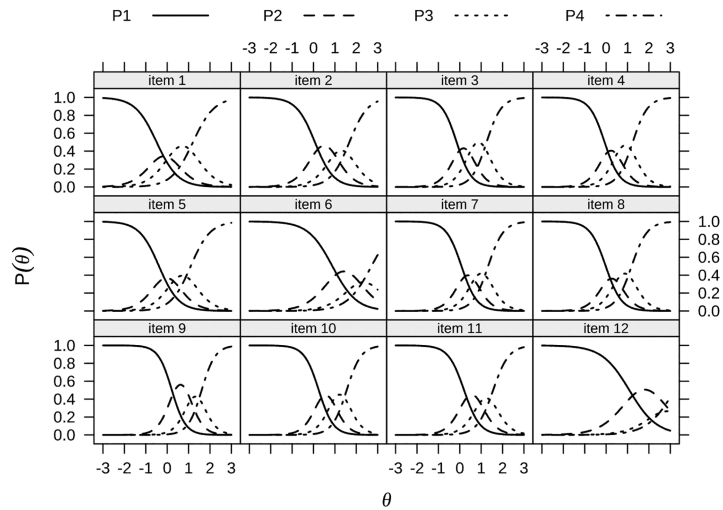


Figure 3 Category characteristic curve of PCWS

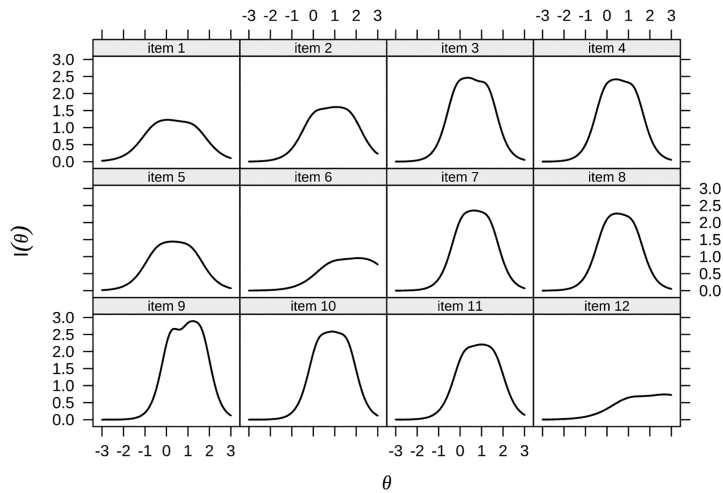


Figure 4 Item information curves of PCWS

the highest threshold parameters ranged from 1.08 to 3.16, as detailed in Table 2 and Figure 3. Additionally, the item information curves are depicted in Figure 4.

Discussion

The present study developed and psychometrically evaluated the Perceived Changes in Well-Being Scale (PCWS) among Japanese school

students, employing a sequential analytical framework incorporating EFA, bifactor modeling, and GRM-based IRT. The results provide broad support for the scale's reliability and validity, while also yielding theoretically informative findings regarding the severity ordering of lingering effects following bullying victimization.

EFA identified a three-factor structure corresponding to physical symptoms, emotional distress, and psychosocial withdrawal, consistent with prior

conceptualizations of the multidimensional nature of psychological harm following peer victimization. The strong internal consistency observed for both the overall scale and each subscale, confirming the scale's suitability for use in Japanese school samples. Importantly, bifactor modeling demonstrated that despite the presence of three substantive subfactors, a dominant general factor accounts for the majority of common variance. This finding carries substantive implications for understanding the psychological consequences of bullying victimization: rather than constituting discrete, independent symptom clusters, physical symptoms, emotional distress, and psychosocial withdrawal appear to reflect a single underlying dimension of generalized psychological harm. This is consistent with the broader victimization literature suggesting that the consequences of chronic peer victimization are pervasive in nature (Arseneault, 2018), and aligns with the dose-effect model wherein more severe victimization produces increasingly global — rather than domain-specific — deterioration in psychological functioning (Wolke & Lereya, 2015). In the Japanese context, where bullying tends to involve sustained relational forms of aggression rather than isolated physical incidents (Shu et al., 2023), the emergence of a unified harm dimension may reflect the cumulative, diffuse burden imposed by chronic social exclusion and interpersonal threat on victims' overall psychological state.

Moreover, The GRM yielded adequate model fit and enough discrimination parameter estimates for all items, indicating that the scale items are highly effective at differentiating individuals at varying levels of victimization-related psychological burden. The scale demonstrated maximal measurement precision for individuals experiencing moderate to severe psychological consequences, rather than those with minimal or no perceived

harm — precisely the population of greatest clinical and policy concern. This calibration is particularly well-suited to the investigation of high-frequency bullying victimization, which, as Shu et al. (2024) demonstrated, represents the most persistent and resistant subgroup within the broader victimization distribution.

The relatively low threshold parameter observed for tiredness suggests that it may emerge at comparatively lower levels of the latent harm continuum — that is, it is among the first consequences to become detectable as victimization severity increases. In contrast, sleep difficulty exhibited a higher threshold parameter, indicating that it emerges later along the severity continuum. The item information curves for both physical items displayed relatively flat, broad distributions, indicating that while such symptoms are widely prevalent among victims, they are less diagnostically precise indicators of severe or chronic victimization. These findings are consistent with prior research documenting somatic complaints as among the earliest and most common responses to peer victimization (Gini & Pozzoli, 2009; Due et al., 2005), and support their potential utility as early screening indicators in school-based surveillance. Although somatic symptoms are multidetermined and cannot be attributed to bullying victimization alone, their early emergence in the IRT severity hierarchy suggests that their presence in the context of suspected victimization warrants systematic follow-up.

In marked contrast, items assessing perceived deterioration in relationships with parents and teachers exhibited substantially elevated threshold parameters alongside comparatively flat and low item information curves. This pattern indicates a pronounced floor effect: the majority of victims, even those experiencing considerable psychological distress, do not perceive their relationships

with significant adults as worsening. Only those in the most severe stratum of victimization-related harm report relational deterioration with these figures. This finding carries important theoretical and practical implications. Relationships with teachers and parents have been identified as critical protective factors against recurrent and escalating victimization in Japanese school contexts (Kato et al., 2017; Ota & Kato, 2018), functioning as social buffers that attenuate the risk of chronic exposure. When these protective relationships are perceived as deteriorating, victims lose access to precisely the resources most likely to interrupt the victimization cycle, placing them at substantially heightened risk of persistent, high-frequency victimization — the subgroup shown by Shu et al. (2023, 2024) to be most resistant to reduction over time. The rarity with which this consequence is endorsed, combined with its severity-threshold positioning in the IRT hierarchy, underscores its potential value as a sentinel indicator of extreme victimization cases warranting immediate intervention.

Taken together, the IRT threshold hierarchy — from tiredness and heightened sensitivity to others' attitudes at the lower end, through affective, motivational, and sleep-related consequences in the mid-range, to relational deterioration at the upper extreme — offers a theoretically coherent map of symptom progression as bullying victimization intensifies. This ordering is consistent with the dose-effect model documented in longitudinal research (Wolke & Lereya, 2015; Takizawa et al., 2014), wherein more severe and chronic victimization generates qualitatively distinct and more pervasive harm. Crucially, the scale's concentration of measurement precision in the moderate-to-severe range renders it particularly well-suited for investigating the high-frequency victimization subgroup — those cases that epidemiological data

suggest are failing to decline despite broader reductions in overall bullying prevalence. For these students, the PCWS provides a sensitive and psychometrically grounded tool for characterizing the severity and configuration of harm experienced.

Several limitations warrant acknowledgment. First, the cross-sectional design precludes causal inferences regarding the temporal ordering of symptom emergence; the IRT-derived severity hierarchy should be interpreted as an index of relative difficulty of endorsement rather than a definitive sequential sequence. Longitudinal designs tracking symptom onset across victimization trajectories would be necessary to validate this ordering empirically. Second, the sample was drawn from a single municipality in Japan, which may limit generalizability to other regional or cultural contexts within and beyond Japan. Third, the floor effect observed for the teacher and parent relationship items, while theoretically informative, also raises the possibility that these items contribute limited psychometric information to the scale under typical sampling conditions; future studies might consider whether supplementary items targeting milder relational strain could improve scale coverage at the lower end of the severity continuum. Finally, while the bifactor evidence supports unidimensional IRT estimation, the three-factor structure identified in EFA suggests that subscale-level analyses — potentially employing multidimensional IRT — could yield additional nuance regarding which symptom domains are most strongly implicated at different victimization severity levels.

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要 旨

本研究は、項目反応理論を用いて、日本の児童生徒を対象とした「ウェルビーイングの知覚的变化尺度」の心理測定学的特性を検証した。探索的因子分析では、身体症状・心理的苦痛・社会的退縮の3因子構造が確認された。さらにバイファクターモデルの結果から、一般因子の説明力が特殊因子を上回ることが明らかとなり、一次元IRTモデルの適用妥当性が支持された。段階反応モデルによる分析では、身体症状は比較的低い心理的ダメージの水準においても出現することが見出され、いじめ被害の早期指標となり得る可能性が示唆された。これに対し、教師および保護者との関係悪化は、被害が深刻な状況下において生じる傾向が確認された。以上の知見は、いじめ被害の深刻度に応じた心理的影響の生起順序を実証的に示すものであり、その背景にある要因についても考察した。

キーワード：いじめ、ウェルビーイングの知覚的变化、後遺症、項目反応理論

