

The development and validation of Academic Resilience Scale for undergraduates in Taiwan: Rasch analysis

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Abstract. It is crucial for undergraduates to understand their academic resilience when they face academic setbacks or problems in everyday life, but there are few measurements to examine the academic resilience. The study aims to develop the academic resilience for undergraduates, based on the perspective of Martin and Marsh. The results indicated that the separation reliabilities of the scale from three dimensions were .996, .992, and .992, respectively. The person measures from the three dimensions were positively correlated with two criterion variables; that is, learning engagement performance and attitude, as well as hope and optimism, whereas they were negatively correlated with depression. The orderings of item difficulties of the three dimensions were also fitted in with the validation evidences. Our findings suggest that researchers and practitioners can be confident in their interpretation of the Academic Resilience Scale.

1. Introduction

After entering higher education, undergraduates may experience challengeable learning processes, adapt themselves to various learning environments, and suffer from learning frustrations. Therefore, undergraduates have to confront these academic challenges and to get over these academic pressures. The prevalence of problems is worth investigating undergraduates on their academic resilience. However, fewer measurements have examined academic resilience among undergraduates. It is necessary to understand whether undergraduates have an ability to effectively deal with academic setbacks. Martin and Marsh defined academic resilience as a students' ability to cope with academic frustrations and challenges in the typical and ordinary everyday school life [1]. They adapt individuals to environmental adversities or difficult circumstances and to make people orientate proactive behavior and healthy attitude while suffering from challenges and adversities [2]. In addition to general individuals, students might also confront some academic problems every day, such as poor achievement, test pressure, and academic challenges, especially during high school [3].

In terms of the construct of academic resilience, the unidimensional construct which Martin and Marsh developed to assess the extent of academic resilience are composed of six items [4]. However, some researchers suggested that resilience contain multiple dimensions. For example, Jew, Green, and Kroger built a four-factor resilience scale consisting of active optimism, passive optimism, social optimism, and independence/risk-taking [5]. McTigue, Washburn, and Liew developed a three-dimensional scale of academic resilience in reading, including engagement, self-monitoring, and help-seeking [6]. Due to divergent perspectives on the construct of academic resilience, it is necessary to make it clear so that we can better understand the conceptions on academic resilience. In Taiwan, Chan, Yeh, Peng, and Yeh developed multiple dimensions of adolescent resilience inventory, consisted of six constructs including problem solving and cognitive maturity, hope and optimism, empathy and interpersonal interaction, and emotional regulation [7]. Hence, we focused on cognitive perception, emotional regulation, and problem-solving ability in order to develop the construct of academic resilience scale for undergraduates.

Moreover, Martin and Marsh used item analysis to examine the quality of the scale with within-network analyses and to evaluate their validity with between-network analyses based on classic test

theory. However, they used the Likert-style scale to calculate participants' responses and provided data at the ordinal level, not at the interval level. It is inappropriate to analyze ordinal data based on classical test theory. By contrast, in accordance with item response theory, if the data live up to the model's expectation, the Rasch model can transform ordinal data into interval [8]. In addition, the Rasch measurement can obtain a variety of evidences for the validity of measures. It can investigate whether the item in the academic resilience scale has the similar way between genders through the differential item functioning. Therefore, using Rasch model might be a better way to analyze the resilience data.

2. Method

2.1 Participants

There were two samples participating in the scale development, sample 1 for the preliminary and sample 2 for validation. The respondents of Sample 1 were from two public universities and one private university in Taiwan. One class was chosen from each of the three universities. Total 156 undergraduates included 126 females and 30 males, in which majoring 111 liberal art and 45 natural science. For validation sample, data of 502 undergraduates were collected from two public universities and two private universities, including 338 females and 164 males as well as 101 art liberal undergraduates and 401 natural science undergraduates.

2.2 Development of Academic Resilience Scale

First, the research team generated 15 draft items for the academic resilience scale in which there are three dimensions, including cognitive, emotional perception, and problem-solving ability, based on previous literatures. Each dimension included five items. For cognitive perception, an example of the items is "I believe I can deal with the pressure during the test." As to emotional regulation, an example of the items is "I spent some time coping with negative emotion when I got a low grade in a test." For problem-solving ability, an example of the items is "I will plan all kinds of solutions to confront academic difficulties." Each item asked about events or activities occurring within the recent six months in school. Response categorizes to the items were rated and encoded on a scale of 0 (strongly disagree) to 4 (strongly agree) on a 5-point scale. Second, one professor of testing and measurement was invited to review the item contents according to the construct of academic resilience. The items were revised based on suggestions of this expert. Third, the items were administrated to sample 1 as the pilot and were revised according to the results. Finally, the revised items were administrated to sample 2 for examining psychometric properties of the scale.

2.3 Criterion Variables

2.3.1 Hope and optimism. The subscale consists of 6 items. An example of this item is "I am an optimistic person." Within the dataset of the present study, Cronbach's alpha of the hope and optimism was 0.877 and the separation reliability was 0.987.

2.3.2 Depression behavior. The subscale consists of 7 items. An example of this item is "I am not able to concentrate on my learning." Within the dataset of the present study, Cronbach's alpha of the depression behavior was 0.813 and the separation reliability was 0.993.

2.3.3 Academic engagement performance and attitude. The subscale consists of 8 items. An example of this item is "I am seldom late for school." Within the dataset of the present study, Cronbach's alpha of the academic engagement performance subscale was 0.836 and the separation reliability was 0.999.

3. Result

3.1 Content and Structural Evidence

Regarding the content and structural aspects of validity, we employed the partial credit model (PCM) to examine the fitting quality of each item and the dimensional construct of each scale. Table 1 shows the infit and outfit statistics of the academic resilience scale items and the separation reliability coefficients of each dimension. First, the two fit statistics were used to examine the extent to which individual items fitted the Rasch model. Wang suggested that the two fit statistics generally ranged

from 0.7 to 1.3 logits for the data to fit the model appropriately [9]. If the two fit statistics is lower than 0.7 or higher than 1.3, they indicated that these items didn't discriminate well or provide redundant information. Wilson indicated that items with poor infit and outfit statistics should be taken account of removal from the scale [10]. Therefore, all items had acceptable infit and outfit MNSQ in Table 1. The data from each revised scale fit the PCM well, suggesting that the items of each scale measure a unidimensional construct. Second, the separation reliability is the Rasch analogue to the Cronbach's alpha. Fox and Jones indicated that the index ranges from 0 to 1, with values equal to or greater than 0.8 being regarded as acceptable [11]. In the present study, the separation reliabilities of the measures from the three dimensions were 0.996, 0.992, and 0.992, respectively.

Table 1. Rasch fit statistics for the academic resilience scale items

	Estimate	SE	Outfit MNSQ	Infit MNSQ
Cognitive perception (separation reliability=0.996)				
I1	-0.271	0.062	1.02	1.07
I2	-0.479	0.063	0.95	1.01
I3	1.264	0.062	0.90	0.94
I4	-0.513	0.108	1.14	1.18
Emotional regulation (separation reliability=0.992)				
I5	0.507	0.036	1.13	1.13
I6	0.167	0.035	0.97	0.97
I7	-0.292	0.039	1.00	1.01
I8	-0.382	0.063	0.97	0.97
Problem-solving ability (separation reliability=0.992)				
I9	0.295	0.050	1.03	1.03
I10	-0.901	0.050	1.07	1.04
I11	0.344	0.047	0.97	0.96
I12	-0.038	0.085	0.95	0.96

3.2 Generalizability Evidence

For the generalizability aspect of validity, we conducted differential item functioning (DIF) analyses across genders. Wang indicated that a difference of 0.5 logits in the overall item difficulties across groups was regarded as a sign of substantial DIF [9], and Wilson suggested that the difference of all item difficulties across groups is less than 0.426 logits [10]. If an item with substantial DIF was identified, it would be removed from further analysis. DIF analyses were separately conducted for the three-dimensional academic resilience scale in this study. There were two statistically significant differences between genders. In the cognitive perception, females showed an unexpected higher perception than males on item 2, "I will go on studying hard when I have trouble with academic learning." In the emotional regulation, females showed an unexpected higher perception than males on item 2, "I will want my family to give me supports or encouragement when I meet the academic setback." The differences of the overall item difficulties between genders on these items were 0.188 logits and 0.148 logits. However, the differences of the two item overall difficulties were less than 0.426. All items didn't exhibit substantial DIF between genders.

3.3 External Evidence

Finally, to evaluate the external aspect of validity, we employed the Pearson's correlation to obtain the estimation of correlations between the measure from three dimensions and criterion variables. The three dimensions of academic resilience were mutually correlated 0.465, 0.568, and 0.624. The correlations between the three dimensions and the learning engagement were 0.407, 0.275, and 0.343, respectively. The correlations between the three dimensions and the hope and optimism were 0.244, 0.287, and 0.323, respectively. That is, better cognitive perception, emotional regulation and problem-solving ability undergraduates owned, better learning engagement performance and attitude and hope and optimism they had. Finally, the correlations between the three dimensions and the depression were -0.353, -0.164, and -0.384, respectively. That is, better cognitive perception, emotional

regulation and problem-solving ability undergraduates owned, lower depression they had. The results provide evidence to support the external aspect of validity for the three dimensions of academic resilience scale.

Table 2. The correlations between three dimensions and criterion variables

	Learning engagement	Hope and optimism	Depression
Cognitive perception	0.407***	0.244***	-0.353***
Emotional regulation	0.275***	0.287***	-0.164***
Problem-solving	0.343***	0.323***	-0.384***

*** $p < .001$

4. Conclusion

One important finding of this study is that the Rasch analysis supported the unidimensionality of the three dimensions of academic resilience scale. Moreover, in the validation phase, all items were fitted in with the content and structural, generalizability and external aspects of validity.

The Rasch analysis also demonstrated that the academic resilience was equivalent across genders. All items did not display significant DIF between male and female groups. This finding indicates that the academic resilience items are not influenced by criterion variables such as genders and that undergraduates with the same level of perceived cognition, emotion, and problem-solving ability of academic resilience have equal probability of item success. This finding supports the validity of inferences regarding gender differences for the academic resilience.

In summary, the development of the three dimensions of academic resilience is one of the strengths of this study. The Rasch analysis demonstrated that the academic resilience had acceptable psychometric properties as a unidimensional measure of undergraduates' perceived cognition, emotion, and problem-solving ability of academic resilience. The academic resilience functioned well and equivalently across genders. Although future studies are needed to replicate these results in additional settings, our findings suggest that researchers and practitioners can be confident in their interpretation of the academic resilience scores when used with samples containing males and females.

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