

Effects of Academic Achievement and Academic Self-Concept on the Self-Efficacy and Mental Health of Students with Learning Disabilities

Wan-Feng Chang¹

Research on the internal/external frame of reference model (I/E model; Marsh, 1986) has established a strong positive correlation between academic achievement in specific subjects and corresponding academic self-concept (ASC). The model also established a negative correlation between achievement in one subject and ASC in other subjects. The model also established a negative correlation between low academic achievement and ASC. However, few studies have explored the causal relationships among achievement, ASC, self-efficacy, and mental health using an I/E model framework. This study examined the effects of domain-specific academic achievement and ASC on self-efficacy and mental health using an extended I/E model to assess the indirect effects of domain-specific academic achievement and ASC on mental health through self-efficacy. The sample included 1,079 students (318 students with learning disabilities [LDs] in grades 4–6), with the students without LDs serving as a control group. The results of the analysis indicated that students with LDs scored lower than their peers without LDs with respect to all variables except mental health. Compared with students without LDs, who engaged in social comparisons (comparing their own performance to that of their peers) across subjects, students with LDs primarily made social comparisons within mathematics. Additionally, students with LDs made dimensional comparisons (comparing their own performance across different subjects) between their mathematics achievement and their Chinese language ASC. Furthermore, the ASC of students with LDs is a direct predictor of self-efficacy and an indirect predictor of mental health through its influence on self-efficacy. The findings of this study suggest that ASC is positively correlated with self-efficacy and that self-efficacy does not directly influence mental health. This study provides empirical evidence of the effects of academic performance and self-concept on self-efficacy and mental health in students with LDs, offering insights for school psychology research and practice.

Keywords: academic achievement, academic self-concept, self-efficacy, learning disabilities, mental health

¹ Center of Teacher Education, National Pingtung University

Corresponding author:

Wan-Feng Chang, Center of Teacher Education, National Pingtung University. Email: wanfeng0603@gmail.com

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In addition to improving motivation to learn, a good self-concept is also a critical factor in children and adolescents' social and emotional well-being (Marsh et al., 2015). Academic self-concept (ASC) is closely related to academic achievement (Marsh et al., 1988). From a skill development model perspective, prior academic achievement is one of the determinants of academic self-concept (Marsh et al., 1999). Conversely, Poor academic achievement can negatively affect academic self-concept, reducing learning motivation and academic performance (Marsh & Craven, 2006). The relationship between ASC and academic achievement has been demonstrated (Chen et al., 2013; Marsh & Köller, 2004; Marsh & Yeung, 1997; Möller et al., 2014). In Asia, poor academic performance leads children to develop negative self-perceptions through experience and interpretation of the environment because of the high emphasis on academic achievement. Wu and Kuo (2015) argue that in Asian cultures, poor academic achievement is a precursor to low self-concept.

The formation of self-concept results from the interaction between the individual and the environment and is influenced by various internal and external factors, such as feedback from significant others and the self (Schmidt et al., 2017). Marsh (2007) showed that two students in the same grade may have highly different self-concepts because of the different comparison standards or reference groups that individuals use to assess their abilities. Marsh (1986) indicated that when forming an ASC, individuals rely on two comparison processes: social (external) comparison, where the individual compares their achievements in a given subject with peers in the same subject to form their academic evaluation. For example, if their math grades are lower than their peers, the individual will have a negative math self-concept. The second process is dimensional (internal) comparison. Students compare their achievements in different subjects to form an ASC. If individual achievement in math is better than verbal achievement, the math self-concept will be better. Under the joint operation of social and dimensional comparisons to construct domain-specific ASCs, Marsh referred to the internal and external frame of the reference model (I/E model). For example, if a student's verbal performance is lower than that of his or her peers, his or her verbal ASC may also be poor; however, if the students verbal course grades are higher than his or her math grade, his or her verbal ASC will be relatively higher than his or her verbal ASC. These two processes showed low or no correlation between verbal and math ASC.

In addition to cross-sectional studies, I/E models have been confirmed in longitudinal studies (e.g., Niepel et al., 2014), qualitative studies (e.g., Müller-Kalthoff et al., 2017), experimental and quasi-experimental studies (Möller & Köller, 2001), meta-analyses (Möller, Pohlmann, et al., 2009), and cross-national studies (Marsh et al., 2015). However, the related research has focused mainly on middle school students, and there is a relative lack of study on elementary school students (Arens & Preckel, 2018; Lohbeck & Möller, 2017; Marsh et al., 2015; Schmidt et al., 2017). Generally, self-concept development in early childhood is highly positive, and there is no strong correlation with academic achievement; however, the greater the experience is, the more significant the correlation with external factors (Donohue et al., 2010; Lohbeck, 2019; Marsh, 1990).

Difficulties in reading, writing, literacy, and numeracy result in a significant academic gap between students with LDs and those without LDs (Chang, 2021; Strein, 2006; Strein & Signor-Buhl, 2005), whereas they also have behavioral problems in learning, such as difficulty maintaining a good attitude and lack of motivation and interest (Murray et al., 2000). Learning and behavioral difficulties negatively affect ASC, resulting in decreased task avoidance and motivation and lower achievement (Zelege, 2004). The interaction between academic performance and ASC creates a negative cycle (Möller, Strebblow, et al., 2009). Therefore, some scholars claim that persistently low achievement will negatively affect the self-concepts of students with LDs (Chapman, 1988; Szenczi et al., 2018; Zelege, 2004), which are lower than those of non-LD peers (Bear et al., 2002; Chapman, 1988; Prout et al., 1992; Zelege, 2004). Several studies take a different view; for example, Kistner and Osborne (1987) argued that with the support of special education services, students with LDs do not develop negative self-concepts with age. Previously, the specific ASCs of students with LDs were rarely explored (Chapman, 1988; Möller, Strebblow, et al., 2009; Zelege, 2004).

In particular, most of the learning problems of students with LDs involve literacy and math; however, when exploring the global ASC, it is difficult to determine whether difficulties in specific subjects cause students to suffer from a lower self-concept in verbal and math. Few studies have investigated the relationship between specific ASCs and the academic achievement of students with LDs (Strein, 2006; Strein & Signor-Buhl, 2005). According to the I/E model, students with LDs may suffer from a decrease in their self-concepts and poor academic achievement. However, whether students with LDs can make dimensional comparisons between two subjects, resulting in a negative correlation between noncorresponding achievement and self-concept, remains to be explored. Only two empirical studies have evaluated the I/E model for students with LDs (Chang, 2021; Möller, Strebblow, et al., 2009). Möller, Strebblow, et al. (2009) found that students with LDs in grades 5-9 make social and dimensional comparisons and confirmed that the I/E model also applies to LD groups. Chang's (2021) findings show a correlation between academic achievement and the ASC of students with LDs in grades 4-6 in the same subject; that is, only social comparison. These results are inconsistent, and by further exploring the relationship between academic achievement and the ASCs of students with disabilities, more specific assistance and teaching interventions can be provided.

In addition to academic achievement and ASC, students with LDs also have psychosocial problems. First, they are at greater risk for behavioral problems, substance abuse, and suicide than general students (Cosden, 2001; Sorensen et al., 2003). These individuals are frequently less accepted and more rejected by their peers (Lackaye & Margalit, 2006; Piers & Duquette, 2016); additionally, they have relatively low self-efficacy and social emotions (Lackaye & Margalit, 2006; Piers & Duquette, 2016; Seyed et al., 2017), and psychological disorders such as anxiety and depression tend to be more common among these individuals than among their non-LD peers (Al-Yagon, 2016; Maag & Reid, 2006; Nelson & Harwood, 2011). Therefore, an LD is a risk factor (Goldberg et al., 2003; Harðardóttir et al., 2015; Morrison & Cosden, 1997). Academic achievement affects ASC, self-efficacy (Lackaye & Margalit, 2006; Rao & Tamta, 2015; Tabassam & Grainger, 2002), and mental health (Bas, 2021). Wu and Kuo (2015) argued that achievement and mental health have no linear relationship and that there should be other mechanisms of psychological processes. In the past, the I/E model explored only the relationship between academic achievement and ASC and failed to determine the causal relationship between these two factors and the psychosocial status of students with LDs. However, Chang (2022) research found that self-efficacy mediates the relationship between self-concept and mental health in both students with and without LDs. Expanding the I/E model allows for a more precise delineation of the pathways through which academic achievement impacts psychosocial development among students with disabilities.

Specifically, the three hypotheses for this study are as follows:

1. Chinese/mathematic academic achievement positively affects ASCs in the corresponding domain and has adverse effects across domains.
2. Academic achievement and self-concept predict self-efficacy.
3. Self-efficacy mediates the relationships between both (a) academic achievement and mental health and (b) ASC and mental health.

When discussing issues related to students with LDs, it is impossible to determine whether students with LDs have similar psychological processes without comparison with their non-LD peers (Donohue et al., 2010; Möller, Strebblow, et al., 2009; Stone & May 2002; Zeleke, 2004). Comparing the psychosocial impact of academic achievement between the two groups provides evidence in practice that allows us to provide services to assist students with LDs.

Internal/External Frame of the Reference Model

The I/E model emphasizes the role of social and dimensional comparisons and explains the formation of individuals' ASCs. The assumptions of the I/E model are based on social comparison theory (Festinger,

1954) and dimensional comparison theory (Möller & Marsh, 2013), both of which emphasize the cognitive process by which individuals evaluate a specific target based on a certain standard. This cognitive process comprises four stages: The individual chooses a specific target for evaluation, selects a certain standard, compares the target with the standard, and finally evaluates the target (Möller et al., 2006). In social comparison, individuals use others as standards for evaluation, and in dimensional comparison, different subjects are compared in terms of goals and standards. The two comparison processes emphasize reference, and both play essential roles in forming an individual's self-evaluations.

Regarding students with LDs, Renick and Harter (1989) found that social comparison is critical for forming ASCs. Students with LDs tend to have lower self-concepts when they have poorer grades than their peers and maintain higher self-concepts when compared with their peers receiving special education services. Gans et al. (2003) and Zeleke (2004) provide similar conclusions. Compared with social comparison, the discussion of the dimensional comparison of students with LDs needs to be revised.

In a study of general students in elementary school, Pinxten et al. (2015) examined 4,436 Dutch fourth-grade students in Chinese and mathematics, and Ehm et al. (2013) examined 1,114 German first- to third-grade children in subjects such as mathematics, reading, and writing. Using data from the 2011 TIMSS and PRIRLS of 67,386 fourth-grade students in 15 countries, Guo et al. (2018) confirmed the hypothesis of the I/E model; however, Lohbeck and Möller (2017) used 291 second-grade students in Germany and only partially supported the hypothesis, with a negative correlation between math achievement and reading self-concept but no significant correlation between reading achievement and math self-concept, indicating that social and dimensional comparison effects on ASCs are less important in second graders. There are only two I/E model studies on students with LDs. Möller, Streblov, et al. (2009) explored the differences in achievement and self-concept between mathematics and language among 270 German students with LDs in grades 5 to 9, and their results supported the I/E model. In Chang's (2021) study, to explore the I/E model between math and Chinese, the participants were 1044 third- to fifth-grade students (353 students with LDs) in Taiwan. The results showed a positive correlation between the academic achievement and ASCs of general students in different grades in the same subject, and there was an effect of social comparison. Moreover, there was no significant correlation between the corresponding achievement and self-concepts of students with different LD grades or of noncorresponding subjects. The results indicated that the social comparison and dimensional comparison abilities of the students with LDs had not yet developed. As mentioned above, general students conform to the hypothesis of the I/E model, and their ASCs are formed through social and dimensional comparisons in elementary school—inconsistent results for students with LDs.

Academic Achievement, Self-Perception, and Mental Health

Self-concept and self-efficacy are critical self-perceptions of children and adolescents. Self-concept is an individual's perception and evaluation of himself/herself and results from how an individual perceives himself/herself. Self-concept is formed mainly through personal experience and interpretation of the environment (Bong & Skaalvik, 2003); from the perspective of skill development models, changes in self-concept may be caused by improved achievement; that is, self-concept is an evaluation of one's abilities (Sternke, 2010). Self-efficacy is an individual's belief about their capabilities that influence his or her performance and behavior (Lackaye & Margalit, 2006). Good self-efficacy results in positive academic motivation, confidence, and persistence and enables students to achieve their goals. Thus, self-efficacy is positively correlated with success (Sivandani et al., 2013). Tabassam and Grainger (2002) claim that there is a strong relationship between self-concept and self-efficacy, and they must be discussed together to obtain a complete picture of the self-perception of students with LDs.

Academic difficulty constitutes a causal risk factor for lower self-concept (Wu & Kuo, 2015). Consistent results have been found in longitudinal studies (Caprara et al., 2011) and systematic literature

reviews (Richardson et al., 2012). Research on middle school students with LDs has also confirmed the relationship between academic achievement and self-efficacy (Mostafa, 2018), but there is no evidence of a difference in academic self-efficacy between students with LDs and those without LDs (Margalit, 2003; Lackaye & Margalit, 2006; Seyed et al., 2017). Lackaye and Margalit (2006) claim that successful experience is a critical factor in shaping self-efficacy because beliefs and perceptions rooted in past achievements, learning frustration, and emotional experiences are all problems encountered by students with LDs, resulting in their lack of persistence, which in turn results in low motivation. Low self-efficacy over time is associated with anxiety (Schunk, 1989). From an ecological point of view, the environment strongly influences students' self-concepts (Makhubu, 2014). It is generally believed that self-concept plays a crucial role in learning and is closely related to adjustment and achievement (Leminen, 2002; Zeleke, 2004)

Wu and Kuo (2015) indicated that academic achievement not only directly affects self-concept but also predicts depression. Self-concept affects many aspects of individuals' lives, including mental health. Bong and Skaalvik (2003) found that students with higher self-concepts had better mental health, well-being, resilience, academic achievement, and satisfaction. Self-efficacy is also positively related to mental health (Chan, 2002) and negatively related to depression, stress, and posttraumatic stress disorder.

Compared with general students, students with LDs have higher anxiety levels because of their low self-concepts and social acceptance. A meta-analysis by Nelson and Harwood (2011) revealed that nearly 70% of students with LDs had more anxiety symptoms than general students (Nelson & Harwood, 2011). In addition, in a meta-analysis, students with LDs were shown to be at greater risk of depression (Bender & Wall, 1994; Newcomer et al., 1995), and the proportion of these students was significantly higher than that of their non-LD peers (Maag & Reid, 2006; Nelson & Harwood, 2011). Several studies have shown that students with LDs may not meet the criteria for depression but tend to have higher levels of depression than their non-LD peers (Maag & Reid, 2006; Mammarella et al., 2016).

In summary, the better the academic performance of an adolescent is, the better his or her self-perception, which in turn leads to positive mental health, and these factors are closely related to each other. Therefore, based on the I/E model, the present study aimed to integrate self-efficacy and mental health to examine the impact of academic achievement on the self-perceptions and mental health of students with LDs and compare these factors with those of general students to determine whether the two groups have similar psychosocial processes. Based on the above review of the literature, this study assumes the following: (1) Chinese/math achievement has positive effects on ASCs in the corresponding domain and has adverse effects across domains; (2) academic achievement and self-concept predict self-efficacy; and (3) self-efficacy mediates the relationships between both (a) academic achievement and mental health and (b) ASC and mental health. The model tested was based on the hypotheses described in the previous sections and is shown in Figure 1.

Method

Participants

The participants in this study included 318 students with LDs (209 boys and 108 girls) and 761 general students (377 boys and 364 girls) who were recruited from elementary schools (grades 4 to 6) in the second semester of 2018 in the southern city of Taiwan. All students with LDs were certified by the Department of Education criteria consistent with the Taiwan Law of Special Education. All of them were identified as meeting the following criteria: Having (a) average or above-normal intelligence; (b) significant differences in intrinsic individual abilities; and (c) significant difficulties in oral expression, basic reading skills, reading comprehension, written expression, listening comprehension, arithmetic, or mathematics reasoning and ineffective improvement despite identified interventions provided by general education.

For sampling, based on the categorization of the degree of urbanization by Zhao et al. (2012), the city was stratified into four levels: Low, medium-low, medium, and high. For the general student sample, the target population was all students in grades 4-6 in the city, with 280 students selected from each grade by stratified random sampling based on the proportion of the target population in each level. For students with LDs, the target population was students in grades 4-6 who were identified with LDs for that academic year in the city. Stratified sampling was conducted to select 140 students from each grade based on the proportion of the target population across the four levels. The participants with LDs were in general classes and had been placed in a special education pullout class for reading and mathematics at their schools. The participants spent 2-3 hours a day in a resource room program and received academic assistance from a special teacher.

After informing the teachers of the purpose of this research, the parents were invited to provide consent, and the instruments were mailed to the school. The general students complete the instruments in their classrooms as administered by the teacher according to the instruction manual. In contrast, students with LDs were completed the instrument in the resource room as administered by a special education teacher, who read the items aloud if they had difficulty reading. The questionnaire and achievement test take approximately 20 and 40 min to complete, respectively.

Instrument

The instruments used in this study comprise the Academic Self-Concept Scale, Self-Efficacy Scale, Mental Health Questionnaire, and Academic Achievement Test, as described below.

Academic Self-Concept (ASC)

ASC was measured using the Chinese version of the Self-Description Questionnaire I (SDQ-I-C) (Wu et al., 2008), which assesses students' self-concepts in mathematics and Chinese. The SDQ-I has good reliability and validity, with Cronbach's α coefficients ranging from .82 to .93 for each factor and .91 for the overall scale (Marsh, 1990). The SDQ-I-C has 76 questions on three academic factors (Chinese, math, and school), four nonacademic factors (physical, appearance, parents, and peers), and general factors. The SDQ-I-C also has good reliability, with Cronbach's α coefficients ranging from .75 to .94, and the α coefficient for the overall academic subscale (Chinese, mathematics, and school) is .94. This scale uses seven questions in each of the two dimensions of Chinese and mathematics. The items are rated on a scale ranging from 1 (do not agree) to 4 (agree) on a four-point Likert scale. Higher scores indicate better self-concepts. The α coefficients for the overall sample in this study ranged between .93 and .96 for the Chinese language, mathematics, and full scale. The Cronbach's α s for self-concept in the Chinese language were .94 and .91 for students with LDs and for the general students, respectively; the Cronbach's α s for self-concept in mathematics were .97 and .96, respectively.

Self-Efficacy

Seven items to assess students' general self-efficacy were adjusted from student questionnaires in the Special Needs Education Longitudinal Study (SNELS) in Taiwan. In terms of questionnaire selection, based on the definition of self-efficacy in the literature, questions matching the construct were selected, and reviewed by three scholars to confirm that the questions align with the research purpose. After compilation was completed, 5 scholars, 5 elementary school general education teachers, and 5 elementary school special education teachers were invited to conduct a content validity check, and it was tested with 20 grade 3-5 students with disabilities, and questions that were difficult for them to understand were revised.

The responses were scored on a 4-point Likert-type scale ranging from 1 (do not agree) to 4 (agree).

Higher scores indicate better general self-efficacy. An example item is “I can make my own decisions.” The Cronbach’s α s for the students without LDs and with LDs were .82 and .86, respectively.

Mental Health

The Mental Health Questionnaire was adopted from the SNELS student questionnaire to assess students’ mental health. The World Health Organization divides mental health into positive subjective well-being and healthy functioning, as well as adverse mental disorders and functional disabilities (World Health Organization, 2004). In this study, mental health refers to the degree to which students do not have emotional or psychological distress. Regarding item selection, based on the definition of mental health above, three scholars selected and reviewed matching questions to confirm alignment with the research purpose.

Six items were scored on a four-point Likert scale ranging from 1 (do not agree) to 4 (agree), with higher scores indicating better mental health. An example item is “Recently, I often do not sleep well and feel tired.” After the compilation was completed, five scholars, five elementary school general education teachers, and five elementary school special education teachers were invited to conduct a content validity check, and it was tested with 20 grade 3-5 students with disabilities. Questions that were difficult for them to understand were revised. Reliability ranged from .60 to .67. Cronbach’s α s for students with LDs and general students were .88 and .84, respectively.

Academic Achievement

The academic achievement tests used in this study were self-compiled, including tests of academic achievement performance in Chinese and mathematics. Three teachers developed test questions, editing test questions from the 6th, 8th, and 10th volumes of teaching content, with one teacher first developing questions for Chinese and mathematics in each volume and then two other teachers reviewing the questions. Teachers editing test questions were asked to focus on the common learning content in each version to reduce differences due to variations in school progress. In terms of dimensions of test development, mathematics questions were divided into “Numbers and Quantity,” “Algebra,” “Geometry,” and “Statistics and Probability” based on the learning content classification in the Mathematics field of the National Education Curriculum Outline; Chinese was divided into “Phonetic Correspondence,” “Word Understanding,” “Sentence Understanding,” “Passage Understanding,” “Inferential Comprehension,” and “Critical Comprehension” based on the dimensions of the language proficiency test developed by the National Academy for Educational Research. Each volume had 25 questions for Chinese and mathematics, respectively, edited based on a two-way blueprint table, and in terms of difficulty, included simple, medium, and difficult levels, with the number of questions being 6, 12, and 6, respectively. All questions had four options to choose from. Below is a brief explanation of the evidence for the reliability and validity of the academic achievement tests.

The 25 items on the Chinese and math achievement tests and the items used for examining students’ abilities were selected based on Taiwan’s current national curriculum learning level. The students’ abilities were calculated using Winsteps software, version 4.55, through joint maximum likelihood estimation. The results showed that the outlier-sensitive fit mean square (Outfit MNSQ) of the achievement tests for Grade 4-5 students ranged from 0.99 to 1.00. The information-weighted fit mean square (Infit MNSQ) ranged from 1.00 to 1.12, the Infit MNSQ of the achievement tests for students in mathematics ranged from 0.99 to 1.00, and the Outfit MNSQ ranged from 1.06 to 1.10, which are acceptable values in the range of 0.5 to 1.5 (Linacre, 2008). In addition, the reliability of the questions in Chinese ranged from .96 to .98 across grades, and the reliability of the questions in mathematics ranged from .97 to .98.

Analysis

Descriptive statistics, correlation coefficients, and *t* tests were performed using SPSS version 23. AMOS version 23 was used to test the hypotheses through path analysis. This study extended the I/E model to self-efficacy and mental health. In addition to examining the relationship between academic performance and the ASCs of students with academic disabilities via the traditional I/E model, this study also examines the relationship between academic achievement and self-concepts for self-efficacy. For mental health effects, the research hypotheses are as follows: First, Chinese/math academic achievement has positive effects on ASCs in the corresponding subjects and adverse effects in the noncorresponding subjects; second, academic achievement and ASCs are positively associated with self-efficacy; and third, self-efficacy partially mediates the relationships between academic achievement, ASCs, and mental health. Figure 1 shows a graphic representation of the structural equation model that combines these hypotheses.

We used the maximum likelihood estimation (MLE) method. To analyze the goodness of fit, the model was evaluated according to the following indicators: χ^2 , comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). For the CFI indices, values greater than .90 are typically considered acceptable, and values greater than .95 indicate a good fit to the data (Bollen, 1989; Byrne, 2001; Hu & Bentler, 1999). RMSEA values less than or equal to .05 suggest a close fit, and values ranging between .05 and .08 suggest an adequate fit. SRMR values of .05 suggest a good fit, and values ranging between .05 and .10 suggest an acceptable fit (Hu & Bentler, 1995).

In addition, multigroup path analysis was conducted to verify differences in the effect relationship between the two groups, and $\Delta\chi^2$ and Δ CFI were evaluated to confirm the differences. Table 2 provides the model fit information for the models tested. Before performing the multigroup path analysis, the theoretical model was fitted to the data obtained from the two groups separately to ensure adequate model fit. Assessing equivalence across groups involves testing sets of parameters increasingly restrictively through the hierarchical ordering of nested models, where each model constrains more parameters than the preceding model (Arbuckle, 2012; Byrne, 2004). Four nested models (unconstrained, structural weights, structural covariances, and structural residual models) that tested three sets of structural parameters (regression paths, covariance of predictor variables, and covariance of residuals) were produced for each of the three path analyses (Table 2). For nested comparisons, the fit indices used were $\Delta\chi^2$ and Δ CFI, where Δ CFI is not affected by sample size and is invariant if its absolute value is less than or equal to 0.01 (Cheung & Rensvold, 2002; Little, 1997).

Results

The means, standard deviations, and correlations among the variables are presented in Table 1. Most of the variables had higher scores for general students than for students with LDs. There were no statistically significant differences in the Chinese self-concept between students without and with LDs ($t = 1.98, p = .05$). By comparison, the difference in Chinese achievement between the two groups was significant ($t = 21.87, p < .001, \eta^2 = .31$). After controlling for achievement (Chinese SC, covariate: Chinese; math SC, covariate: math). The self-concepts in Chinese ($F = 10.12, p = .002, \eta^2 = .01$) and math ($F = 76.42, p < .001, \eta^2 = .07$) were significantly different between the two groups; furthermore, in terms of mental health, students with LDs were better than general students ($t = -7.83, p < .001, \eta^2 = .05$). The Pearson correlation coefficients are presented in Table 1.

Table 1

Mean (M), Standard Deviations (SD), and Correlation Coefficients for Students with and without LDs

	NLD		LD		T	1	2	3	4	5	6
	M (SD)	M (SD)	M (SD)	M (SD)							
1. Chinese ASC	2.80 (0.71)	2.70 (0.82)	1.98	–	.12*	-.03	-.15*	.35***	.22***		
2. Math ASC	2.60 (0.89)	2.38 (0.91)	3.63***	.19***	–	.01	.16**	.32***	.16**		
3. Chinese ACH	0.71 (1.17)	-0.87 (0.79)	21.87***	.14***	.15***	–	.38***	.14*	.09		
4. Math ACH	0.15 (1.21)	-0.90 (0.78)	15.57***	.04	.29***	.64***	–	-.02	-.01		
5. Self-efficacy	3.38 (0.53)	3.24 (0.62)	3.79***	.34***	.23***	.04	.04	–	.34**		
6. Mental health	2.67 (0.85)	3.09 (0.64)	-7.83***	.004	.03	.04	.03	.08*	–		

Note. Correlation coefficients from students with LDs are shown above the diagonal. CSC = Chinese self-concept; MSC = math self-concept; Chinese ACH = Chinese achievement test; math ACH = math achievement test.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Before fitting the theoretical model to the empirical data, we first tested the measurement models by performing confirmatory factor analyses (CFAs) to check the factor structure. The fit indices revealed that the path model for both groups had a satisfactory fit to the data (see Table 2), where the general students [$\chi^2(4) = 4.35$, $p = .36$, CFI = 1.00, RMSEA = 0.01, SRMR = 0.02] and the students with LDs [$\chi^2(4) = 5.90$, $p = .21$, CFI = 0.99, RMSEA = 0.04, SRMR = 0.03] showed that the multigroup analysis was suitable for the assumed model of both groups. The results of the multigroup analysis for comparing the unconstrained and structural weight models yielded a $\Delta\chi^2 = 39.62$, $df = 4$, $p < .001$, and $\Delta CFI = .03$, demonstrating the difference between the unconstrained and constrained models and, therefore, a significant difference between the two groups. The results showed that the model was not invariant for the two groups; the unrestricted model had the best fit for model comparison, which indicated that it was suitable to review the model results for both groups separately.

Table 2

Goodness-of-Fit Indices for Models Tested for Students without and with LDs

Model	χ^2	p	df	CFI	RMSEA	SRMR	AIC	$\Delta\chi^2$	Δdf	ΔCFI
Students with LDs	5.90	.21	4	0.99	0.04	0.03	39.90	–	–	–
Students without LDs	4.35	.36	4	1.00	0.01	0.02	38.35	–	–	–
Multi-group										
Unconstrained	10.26	.25	8	0.99	0.02	0.02	78.26	–	–	–
Structural weights	49.98	< .001	17	0.96	0.04	0.04	99.98	39.62	5	0.03
Structural covariances	127.45	< .001	20	0.87	0.07	0.04	171.54	77.47	3	0.09
Structural residuals	208.71	< .001	25	0.78	0.08	0.04	242.71	81.26	5	0.09

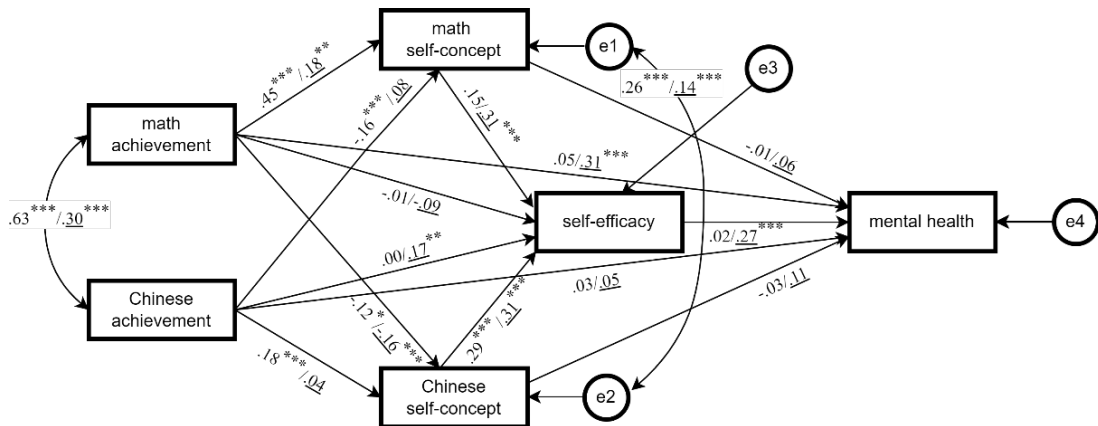
Note. df = degrees of freedom; TLI = Tucker–Lewis index; CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

The standardized path coefficients are shown in Figure 1. Results for the general students showed that in addition to a mutual correlation between academic achievement ($\beta = .63$, $p < .001$), the path coefficient between academic achievement and ASC in the corresponding subject was positive (math: $\beta = .45$, $p < .001$; Chinese: $\beta = .18$, $p < .001$). In nonresponding subjects, the path coefficients representing math achievement/Chinese self-concept ($\beta = -.16$, $p < .01$) and Chinese achievement/Math self-concept ($\beta = -.12$, $p < .05$) were

both negative and statistically significant. The path coefficients between academic achievement and self-efficacy were 0.2 and .06, respectively, in which Chinese/math academic achievement did not predict self-efficacy; however, Chinese ASC ($\beta = .30, p < .001$) and math ASC ($\beta = .15, p < .001$) positively affected self-efficacy, whereas the path coefficients between Chinese ASC and mental health ($\beta = -.03, p = .49$), between math ASC and mental health ($\beta = .01, p = .85$) and between math ASC and self-efficacy ($\beta = .02, p = .53$) were not significant.

Similarly, a positive correlation existed between math achievement and the Chinese academic achievement of students with LDs ($\beta = .30, p < .001$). In terms of the relationship between academic achievement and ASC, math achievement was positively correlated with math ASC ($\beta = .18, p < .01$). In contrast, math achievement and Chinese ASC were negatively correlated ($\beta = -.12, p < .05$). Among the factors influencing academic achievement and self-efficacy, Chinese achievement was shown to have a positive effect on self-efficacy ($\beta = .16, p = .002$). Self-efficacy was significantly predicted by Chinese ASC ($\beta = .31, p < .001$) and math ASC ($\beta = .31, p < .001$), and self-efficacy was positively correlated with mental health ($\beta = .34, p < .001$). In addition, self-efficacy was mediated by the relationship between Chinese ASC/math ASC and mental health, and the direct path coefficient between Chinese/math ASC and mental health was not significantly correlated. In summary, the path analysis showed that ASC predicted both self-efficacy and subsequent mental health and that self-efficacy mediated the effect of ASC on subsequent mental health. The output path diagram is shown in Fig. 1, and the path coefficients of each path were calculated.

Figure 1
Structural Relationship Models for a Group of Students without and with LDs



Note. The parameter estimates on the left are for students without LDs, whereas the parameter estimates on the right (bottom line) are for students with LDs.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Discussion

The present study extends the I/E model to examine the relationships between academic achievement, ASC, self-efficacy, and mental health in LD students and those in general students. The findings of this study can help identify critical mechanisms involved in the relationships among academic achievement, self-perception, and mental health. The results for the students with LDs revealed the direct effect of self-efficacy on mental health and the indirect influence of ASC on the mental health of students with LDs through self-efficacy, indicating that self-efficacy fully mediates the relationship between ASC and mental health. As predicted, the results showed that self-efficacy mediates the relationship between ASC and

mental health in students with LDs; however, unexpectedly, academic achievement and ASC were not directly related to mental health. In line with the findings of previous research, general students exhibit better academic achievement (Lackaye & Margalit, 2006; Strein, 2006; Strein & Signor-Buhl, 2005), ASC (Bear et al., 2002; Chapman, 1988; Prout et al., 1992; Tabassam & Grainger, 2002; Zeleke, 2004), and self-efficacy (Bear et al., 2002; Chapman, 1988; Prout et al., 1992; Tabassam & Grainger, 2002; Zeleke, 2004), while mental health scores are lower than those of students with LDs (Chang, 2023), which is inconsistent with past findings.

There are three possible explanations for these findings. First, students in elementary schools may suffer from LDs but have not yet had their mental health affected. Academic difficulties and low self-concepts are associated with depression (Cole, 1991), while Wu and Kuo (2015) argued that academic achievement affects mental health through self-concept. Their study revealed that for students in grades 5 and 6, the relationship between academic performance and depression was partially mediated by self-concept; for students in grades 3 to 4, the relationship between the two variables was fully mediated by self-concept. These authors indicated that the stress associated with the academic performance of lower-grade students is lower than that associated with the academic performance of upper-grade students. Second, Kistner and Osborne (1987) argued that receiving assistance from special education can reduce feelings of failure and frustration in students with LDs. Most students who are identified as having LDs in Taiwan obtain special education services in the third grade. After two years, although their grades may not improve, they may have better mental health with support, but additional evidence is needed. Third, not every student with LDs has poor mental health. Several studies have demonstrated that age (e.g., Maag & Reid, 2006) and socioeconomic status (e.g., Brunelle et al., 2020) may affect the mental health of students with LDs. Possible background variables can be explored in the future.

In terms of the relationship between academic achievement and ASC, the general students showed that achievement has a positive effect on self-concept in the same subject, indicating that the general students in primary school already have social comparison ability, in which they evaluate their academic performance and self-concept through comparisons with peers, meaning that students with more vital achievement develop higher self-concepts. Moreover, achievement in one subject has a negative effect on the self-concept of the noncorresponding subject. This is interpreted in terms of dimensional comparisons, which positively affect students' ability to improve in this subject, where a more positive self-concept is developed. These results are consistent with those of previous studies on general students (Ehm et al., 2013; Lohbeck & Möller, 2017; Schneider & Sparfeldt, 2020).

Students with LDs have only partial social comparison and dimensional comparison ability; they evaluate their math self-concept correctly by observing their peers. They also evaluate their Chinese self-concept by comparing math and Chinese. This result is similar to Chang's (2021) finding, indicating that students with LDs still need to develop their self-concept fully through peer comparisons or comparisons between intrinsic abilities. Age and cognitive immaturity result in elementary school students' insufficient ability to evaluate their academic performance (Arens & Preckel, 2018; Ehm et al., 2013). Lohbeck and Möller (2017) argue that younger children's overconfidence or less differentiated ASCs are often not congruent with their achievement. Perhaps students with LDs are similar to younger children; in addition, from the perspective of social comparison, in the process of forming self-concepts, students with LDs may not choose ordinary peers but tend to make social comparisons with peers with similar academic abilities (Marsh & Craven, 1997; Klassen & Lynch, 2007; Renick & Harter, 1989; Zeleke, 2004). Möller, Streblov, et al. (2009) argue that the difficulties of students with LDs in Chinese and math affect dimensional comparison. Students with LDs comparing their self-concepts across subjects based on the average performance of all subjects rather than on the best or worst subject remains to be explored further.

In the study of Möller, Streblov, et al. (2009), participants with LDs were in the fifth to ninth grades; perhaps the abilities of social and dimensional comparison mature with age (Ehm et al., 2013; Marsh et al., 2015), but additional evidence is still needed to support this. Regarding dimensional comparisons,

elementary school students with LDs are unaware of the importance of the relationship between learning goals and grades. In addition, learning experiences between different subjects and perceptions of achievement gaps between different subjects may affect the formation of dimensional comparisons (Ehm et al., 2013; Lohbeck & Möller, 2017). Ehm et al. (2013) indicated that dimensional comparison requires better metacognition and that metacognition is lower in students with LDs than in their non-LD peers (Girli & Öztürk, 2017).

Regarding the relationship between academic achievement and self-perception in general students, self-efficacy fully mediated the relationships between corresponding academic achievement and ASC, and academic achievement did not directly affect self-efficacy. The Chinese achievement of students with LDs directly predicts self-efficacy, whereas math achievement mediates self-efficacy through self-concept. In addition, a positive correlation between ASC and self-efficacy was found in both groups. In other words, actual academic performance does not directly affect the self-efficacy of elementary students with and without LDs; rather, their subjective feelings about their studies shape their perceptions of their abilities. Regarding mental health, the self-efficacy of students with LDs fully mediates the relationship between ASC and mental health. In contrast, the self-efficacy of general students has no relationship with mental health. This finding is consistent with the results of Chang (2022), who indicated that the self-efficacy of students with LDs positively affects mental health.

In conclusion, the poor academic performance of general students affects their ASCs, which in turn may lead to decreased self-efficacy but no damage to mental health. A low correlation between academic achievement and ASC is shown for students with LDs, but a higher ASC promotes their self-efficacy, in turn enhancing their mental health through good self-efficacy. Simply put, self-efficacy is an important intrinsic protective factor for students with LDs and is essential for stress regulation (Bandura, 1992; Chang, 2021).

Self-efficacy promotes motivation, persistence, positive coping strategies, and consequently well-adapted outcomes such as mental health (Chang, 2023; Gallagher et al., 2019; Saltzman & Holahan, 2002; Schönfeld et al., 2019). According to the results of this study, general students' academic achievement affects their general self-efficacy through their ASC. In students with LDs, there were positive correlations among ASC, self-efficacy, and mental health. In other words, the stronger the ASCs of students with LDs are, the greater their self-efficacy expectations and the more positive their mental health. On the other hand, self-efficacy predicts academic achievement better than self-concept. Studies by Pajares and his colleagues (Pajares & Graham, 1999; Pajares & Valiante, 1997) have consistently shown that academic self-efficacy better predicts task-specific performance (e.g., mathematical problem solving, writing). Self-concepts are relatively broad perceptions of a person's abilities and self-worth and have limited utility in predicting performance on specific tasks. A specific self-efficacy can be better predicted to assess student performance on a specific task.

Self-concept and self-efficacy are essential components of self-perception or perceived competence that predict motivation, emotion, and performance (Jansen et al., 2015). Although self-concept and self-efficacy are formed by the experience of the environment (Bandura, 1997; Shavelson et al., 1976), they rely on different sources of information. The most important source of self-efficacy is mastery experience (Bandura, 1997), which is influenced mainly by previous experiences of success and failure in similar tasks; these experiences are related to subjective judgments, not comparisons with the abilities of others (Zimmerman, 1995). Therefore, self-efficacy is not closely related to dimensional comparison or social comparison. Academic achievement is an experience (Schunk, 1991; S. Skaalvik & E. M. Skaalvik, 2004); the more successful one's experience of academic achievement is, the greater one's self-efficacy.

On the other hand, ASC is established through social comparison and expands to dimensional comparison with age (Marsh & Köller, 2004; Marsh et al., 1991; S. Skaalvik & E. M. Skaalvik, 2004). In the past, self-concept and self-efficacy have been explored simultaneously using the internal/external frame of reference model (E. M. Skaalvik & Rankin, 1995; S. Skaalvik & E. M. Skaalvik, 2004), and the results have shown that the relationship between academic achievement and self-concept is consistent with the

hypothesis, whereas the relationship with self-efficacy is not.

In this study, students without LDs with poor academic achievement had negative self-concepts, leading to low self-efficacy. In contrast, there was no stable relationship between academic performance and self-concept in students with LDs. However, having a good self-concept can improve self-efficacy, and subsequent self-efficacy has a positive effect on mental health. Simply put, a general student has poor academic performance, which leads to low self-efficacy but does not harm their mental health; however, the low academic performance of students with LDs does not mean that they have poor ASCs; rather, the better their ASCs are, the greater their self-efficacy. Stringer and Heath (2008) believe that the self-perceptions of students with LDs drive more emotion than academics, which may explain the findings of this study.

Cosden et al. (1999) reported that grade decline does not diminish the self-esteem of students with LDs and suggested that students with LDs feel better by reducing the importance of academic skills and enhancing nonacademic strengths. Similarly, Gillan (2008) proposed the compensatory hypothesis, which holds that students with LDs view their abilities not from the perspective of academic or overall school performance success but from the perspective of strengths. E. M. Skaalvik and S. Skaalvik (2008) suggest that the impact of self-perception on achievement may be partly mediated through students' goal orientation. Mastery expectations of learning may increase students' task orientation and performance-approach orientation, which may improve their learning strategies and thus learning performance. In other words, students with LDs lack good learning experience, lack goal setting and have low interest in learning, and academic performance is not the goal of their efforts. Cooley and Ayres (1988) claim that there is a positive correlation between self-concept and the attribution of effort in children with LDs and that self-efficacy is related to attribution (Tabassam & Grainger, 2002). The better the self-efficacy is, the better the intrinsic motivation, the more favorable the self-perceptions, and the more adaptive the attributional patterns (Bong & Clark, 1999). Therefore, regardless of their grades, students with LDs have excellent ASCs and relatively good self-efficacy beliefs, and they can sequentially maintain motivation, persistence, and effort in learning. Finally, they have better mental health.

Limitations and Future Research

This study extends the I/E model to explore the impact of academic achievement and self-concept on the self-efficacy and mental health of students with LDs. By comparison with ordinary students, we can better understand the psychosocial aspects of students with LDs. The following are the limitations of this study. First, previous research has found that domain-specific self-efficacy beliefs are more predictive of educational outcomes than general efficacy beliefs. This study used general self-efficacy rather than academic self-efficacy as a variable. Schunk and Pajares (2002) showed that the relationship between general self-efficacy and academic achievement is weaker than that between specific self-efficacy and academic achievement. When academic self-efficacy is used in the future, there may be a greater correlation between academic achievement and self-concept (Marsh, 1990; Marsh & Craven, 2006; Pajares, 1996; Valentine et al., 2004). In addition, Chinese and mathematics self-efficacy should be included and further explored. Second, background variables such as gender, subtype of learning disability, and parental socioeconomic status were not included in this study. For example, some scholars indicate that because students with LDs constitute a heterogeneous group, difficulty in accessing the language of students with reading disabilities leads to a low self-concept in Chinese, which makes it more challenging to compare subjects.

In practice, the I/E model provides an opportunity to understand the relationship between children's academic achievement and self-concepts, in which social comparison enables self-evaluation based on peers and dimensional comparison provides children with greater insight into academic strengths and weaknesses. Comparisons between subjects can help regulate emotional states and improve self-worth

(Möller & Marsh, 2013). In comparison, students with poor verbal ability have relatively good math self-concepts, which is helpful for subsequent learning behaviors. Therefore, in the learning process, teachers should emphasize improving personal ability or task-solving orientation, providing students with positive thinking and self-talk, and teaching and encouragement in sequence. In this study, the students with LDs in elementary school had not yet established the ability to make social and dimensional comparisons, which may be related to poor metacognition and lack of feedback from others. Teachers and parents should enable students to compare specific things and provide them with feedback on how to compare other people's abilities with their own, which can help them master their actual abilities and make correct judgments. This study confirmed that if students with LDs have positive perceptions of their learning, they will have good self-efficacy, leading to good mental health.

School teachers and parents should assist students with LDs in setting and implementing learning goals according to their abilities, achieving tasks, and making reasonable psychosocial adjustments. In addition to developing essential learning abilities, teachers should encourage students to participate in various extracurricular activities, build their strengths, and improve their motivation to learn. Parents should support their children in developing their interests and habits. Research generally holds that the ASCs of students with LDs decline with academic failure (Chapman, 1988; Zeleke, 2004); however, cross-sectional studies cannot examine individual changes over time from a temporal perspective. The traditional I/E model considers only the influence of social and directional comparisons on ASC. Recently, the impact of an individual's previous academic achievements on subsequent ASC has been incorporated into a model called "temporal comparison," which is one of the factors affecting the formation of ASC. The general student has been confirmed in research (Wolff et al., 2018). For students with LDs, the extent to which previous academic failures persistently affect ASCs remains unclear.

Furthermore, Möller, Streblov, et al. (2009) argued that in social comparison, when students with LDs are compared with their peers, they will have lower self-concepts and a comprehensive decline in learning, resulting in dimensional comparison not being obtained. Renick and Harter (1989) found that the self-concept of students with LDs decreased annually compared with that of the general student population but did not change significantly compared with that of their peers in resource classes. Therefore, future comparisons between students with LDs in regular and resource classes should be conducted to understand the effect of placement type on self-concept. Gans et al. (2003) and Zeleke (2004) suggested that students with LDs may have different self-concepts because of their reference group. Renick and Harter found that, compared with their non-LD peers, students with LDs have self-concepts that decline with age. However, there was no significant difference in self-concept compared with LD peers. Future research including both general and LD peers will make the effect of placement on self-concept clearer.

Third, Strein and Signor-Buhl (2005) suggested that the difference in academic performance between two groups should be considered when comparing the ASCs of average and LD students. There are two methods. The first is to compare the ASCs between the two groups by controlling for academic achievement. This study used covariates to control for academic achievement. Second, compared with students in similar grades, students with LDs encounter difficulties in their studies, and students with low academic achievement also have difficulties; therefore, they may have low self-concepts. Vaughn et al. (1992) argued that academic achievement, rather than being identified as having a learning disability, affects students' ASCs (Vaughn et al., 1992). Chapman (1988) and Zeleke (2004) hold similar views that need to be explored.

Finally, the relationship between academic achievement and ASC is interactive. This study adopts the internal and external reference framework model, which is examined from a skill development perspective, and focuses on how academic achievement predicts ASC, hypothesizing that academic achievement affects its formation. The aim of the study was to examine whether this model applies to students with LDs; thus, a one-directional predictive model was chosen to test this hypothesis. Many studies support the idea that self-concept in turn affects academic achievement, reflecting the interactive nature of the two. Research has

indicated that children are based on the skill development model, whereas older children are self-improving. Three theories discuss the relationship between academic achievement and self-perception, including self-enhancement, skill development, and the reciprocal effects model (E. M. Skaalvik & S. Skaalvik, 2008). Future research should employ more sophisticated models to test bidirectional effects. This approach could provide more profound insights into the dynamic relationships between academic performance and the self-perceptions of students with LDs. In the future, other models should be used to understand the causal relationship between the learning and psychosocial relationships of students with LDs.

Conclusions

Exploring the relationship between academic and psychosocial aspects has long been a critical issue in the study of LDs. These studies aim not only to understand the impact of academics on the psychosocial development of students with LDs but also to intervene. The present research used the I/E model to assess the impact of academic achievement on the self-concept of students with LDs and to extend the relationship to the prediction of self-efficacy and mental health. By comparing these factors among students with LDs and general students, the psychosocial process of the two groups can be clarified. Overall, the results show that, except for mental health, students with academic disabilities score lower than their average peers both academically and psychosocially. According to the I/E model, students with LDs develop only partial social and dimensional comparisons; self-efficacy also mediates the relationship between ASC and the mental health of students with LDs.

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學習障礙和一般學生之學業成績 和學業自我概念對自我效能和心 理健康的影響

張萬烽¹

過去內外參照架構模式的研究，已證實同一科目的學業成就與學業自我概念間有緊密的關連，非對應學科與自我概念間則是負相關。在這個架構下，學業成就與學業自我概念對於兒童與青少年的心理社會影響卻少被討論。本研究以國小四到五年級 318 位學障學生和 761 位一般學生，延伸內外參照架構模式，以探討學業成就與學業自我概念對學障學生自我效能和心理健康的預測性。結果發現，相較於一般學生已建立社會比較，學障學生僅在數學成就與自我概念間具有社會比較；此外，是學業自我概念而非學業成就，對他們自我效能產生影響，進而對心理健康產生作用，而一般學生的學業自我概念雖影響其自我效能，但並未對心理健康有任何影響。最後，依據研究結果提出實務與未來研究之建議。

關鍵詞：學業成就、學業自我概念、自我效能、學習障礙、心理健康

¹ 國立屏東大學師資培育中心

通訊作者：張萬烽，國立屏東大學師資培育中心，wanfeng0603@gmail.com。

