



Thinking styles and self-determination among university students who are deaf or hard of hearing and hearing university students

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ARTICLE INFO

Number of reviews completed is 1

Keywords:

Thinking styles
Self-determination
Deaf or hard-of-hearing

ABSTRACT

This study explores how students' thinking styles are related to their self-determination. The Thinking Styles Inventory-Revised II and the American Institutes for Research (AIR) Self-Determination Scale were administered to 913 university students (480 who were deaf or hard-of-hearing and 433 hearing) in mainland China. Results showed that, among all participants, those with Type I styles (i.e., more creativity-generating, less structured, and cognitively more complex) had higher levels of self-determination, while those with Type II styles (i.e., more norm-favoring, more structured, and cognitively more simplistic) had lower levels of self-determination. The contributions, limitations, and implications of this study are discussed.

1. Introduction

Self-determination refers to "the ability of individuals to live their lives as they choose, consistent with, their own values, preferences, and abilities" (Turnbull, Turnbull, & Wehmeyer, 2010, p. 500). Self-determination has been demonstrated to play an important role in the developmental outcomes of students (Lee et al., 2012). For instance, self-determination is conducive to employment (Martorell, Gutierrez-Recacha, Pereda, & Ayuso-Mateos, 2008) and to higher levels of quality of life and life satisfaction (Lachapelle et al., 2005). Thus, how to enhance individuals' self-determination merits considerable attention.

In general, researchers have attempted to facilitate students' self-determination through either implementing interventions (Wehmeyer, Palmer, Shogren, Williams-Diehm, & Soukup, 2010) or examining its influential factors (Shogren et al., 2007; Wehmeyer, 1999). The focus of this paper is to extend the second line of studies by examining how intellectual styles are related to self-determination. Intellectual styles, including all style constructs such as cognitive, learning, and thinking styles, are defined as individuals' preferred ways of processing information and dealing with tasks (Zhang & Sternberg, 2006). Zhang and Sternberg (2006) and Zhang (2001) have demonstrated that intellectual styles matter greatly across different student developmental domains, and that some are more adaptive and conducive to positive developmental outcomes than others. Although both theoretical and empirical evidence (reviewed later in the present article) implies that intellectual styles may relate to self-determination, few studies have directly examined the relationships between the two. Exploring such relationships could reveal possible ways to enhance students' self-determination from a style perspective. Therefore, it is meaningful to explore how intellectual styles are related to self-determination. In this study, university students who were deaf or hard of hearing (DHH) and university hearing students in mainland, China were selected as participants, for the following three reasons.

First, Luckner and Sebald (2013) have advocated promoting self-determination among students who are DHH. However, to the

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authors' best knowledge, no empirical study has yet been conducted on how to improve self-determination of students who are DHH; exploring factors (in this study, intellectual styles) influencing self-determination of students who are DHH is a significant attempt.

Second, while inclusive higher education enables growing numbers of students who are DHH to access universities, many continue to face such problems as attrition (Boutin, 2008) and depression (Finley, 2013). Given that intellectual styles have been found to play an important role in developmental outcomes of students who are DHH in such areas as academic achievement and university self-efficacy (Cheng, Zhang, & Hu, 2016; Davey & LaSasso, 1984), these issues can be addressed by facilitating the development of university students who are DHH, from the perspective of intellectual styles.

Third, cross-cultural study can verify (by finding similarities) and extend (by finding differences) previous findings (Berry, 1991). As students who are DHH are increasingly perceived as a social-cultural minority (Braithwaite & Thompson, 2000), it is valuable to examine similarities and differences in the relationships between intellectual styles and self-determination among students who are DHH and hearing students.

1.1. *The theoretical framework of self-determination and its influential factors*

Self-determined learning theory—Mithaug et al. (2003) theoretical framework for self-determination—was adopted in this study, as it has been well applied in different studies on self-determination (e.g., Shogren et al., 2008) and it measures global self-determination, which fits the scope of this study.

This theoretical framework highlights the process through which students become self-determined learners. To be specific, it attempts to explain how individuals “interact with opportunities to improve their prospects of getting what they want and need in life” (Wolman, Campeau, Dubois, Mithaug, & Stolarski, 1994, p. 4). Opportunities are pursued, when they are just right challenges, which means that they provide close to optimal opportunities for experiencing gain (Mithaug et al., 2003). When people seek opportunities, they learn to adjust and regulate their thoughts, feelings, and actions. Therefore, this theoretical framework proposes that students' self-determination is decided by their capacities and opportunities. Capacity here refers to the knowledge, abilities, and perceptions that make students become self-determined, while opportunities means the chances offered to students to use their knowledge and abilities relevant to self-determination (Wolman et al., 1994).

Both theoretical and empirical evidence indicates that self-determination is influenced by personal and environmental factors. At the theoretical level, Mithaug et al. (2003) self-determined learning theory indicates that students' self-determination is decided by their capacities (personal factor) and opportunities (environmental factor).

At the empirical level, personal factors (demographic and individual differences) have demonstrated a great influence on self-determination. In terms of demographic variables (e.g., gender and age), findings are relatively inconsistent. Shogren et al. (2007), for instance, identified that females in a sample of students with disabilities from the United States tended to score higher on self-determination, while Nota, Ferrari, Soresi, and Wehmeyer, (2007) found that males with disabilities in a sample of Italian adolescents manifested higher levels of self-determination. Regarding individual difference variables, previous studies have consistently indicated that intellectual functioning is positively related to self-determination (Shogren et al., 2007; Wehmeyer et al., 2012).

Environmental factors also play an important role in self-determination (Shogren et al., 2007; D. Zhang, 2001), as do personal factors (Shogren et al., 2007). Shogren (2013), in a comprehensive review of extant studies, identified four classes of factors influencing self-determination: microsystem (individual factors, disability label, and family factors); mesosystem (school factors, disability support system factors, and community factors); macrosystem (cultural norms and beliefs); and chronosystem (i.e., change occurs over time in the individual and the environment). Results indicate that most studies in Shogren's (2013) review were related to microsystem level factors, especially individual-level factors such as the disability label.

To summarize, previous studies have suggested that both personal and environmental factors significantly influence self-determination. From these studies, it seems three identified major research gaps require further investigation. First, most studies have examined demographic variables, while fewer have focused on individual difference variables. Abery and Stancliffe (1996) indicated that individual difference variables play a key role in the formation of self-determination. Thus, it is meaningful to further explore how individual difference variables (in this study, intellectual styles) are related to self-determination.

Second, most studies have focused on disability groups and excluded non-disabled groups. As a disability can be considered a principal cultural attribute, students with disabilities have been increasingly perceived as a social-cultural minority (Braithwaite & Thompson, 2000). Given that culture affects individuals' perceptions, behaviors, and sense of reality (Wehmeyer et al., 2011), it would be meaningful to examine how the relationships of personal factors (in this study, intellectual styles) to self-determination observed among students without disabilities are similar to or different from those seen among students with disabilities (in this study, students who are DHH).

Third, most studies have been conducted in Western cultural contexts, and considerably fewer in Chinese cultural contexts. As argued by Wehmeyer et al. (2011), culture may play a moderating role impacting the design and implementation of interventions to promote self-determination. Hence, it is worthwhile exploring how personal factors (intellectual styles) are related to self-determination in the Chinese context.

1.2. *Intellectual styles and their associations with self-determination*

Incorporating the main existing style models, such as Holland's (1973) model of career personality types and Sternberg's theory of (1997) thinking styles, Zhang and Sternberg (2005) put forward a threefold model based on the three types of thinking styles identified in the process of investigating the theory of mental self-government as well as upon previous findings in the styles

literature. Within this model, intellectual styles are classified into three types: Type I, Type II, and Type III. Individuals with Type I styles prefer to deal with tasks that are more creativity-generating, less structured, and cognitively more complex, whereas those with Type II styles prefer to perform tasks that are more norm-favoring, more structured, and cognitively more simplistic; Type III styles can “manifest the characteristics of both Type I and II styles, depending on the style demands of a specific task and on an individual’s level of interest in the task.” (Zhang & Sternberg, 2005, p.36) Zhang and Sternberg’s model also argues that Type I intellectual styles often contribute to more desirable human attributes, such as higher levels of cognitive development, while Type II styles are often conducive to less desirable human attributes, such as lower levels of cognitive development.

Until now, no study has directly tested the relationships between intellectual styles and self-determination. However, a possible link may exist between these two variables, one that has both theoretical and empirical foundations.

At the theoretical level, there is a conceptual link between intellectual styles and self-determination. Self-determination refers to the ability of individuals to live their lives as they choose, consistent with their own values, preferences, and abilities, while intellectual styles refer to individuals’ preferred ways of dealing with information and performing tasks. Both constructs emphasize preferences, which means a possible link may exist between the two variables.

At the empirical level, previous research has suggested that personality is strongly related to both intellectual styles (Busato, Prins, Elshout, & Hamaker, 1998; Jackson & Lawty-Jones, 1996; L.F. Zhang, 2001) and self-determination (Ingledew, Markland, & Sheppard, 2004), and that intelligence is strongly related to both intellectual styles and self-determination (Perreault, Mask, Morgan, & Blanchard, 2014; Zhang & Sternberg, 2006). As such, intellectual styles and self-determination could be strongly related to each other, as they share a common space over personality and intelligence.

1.3. The theoretical framework of thinking styles

In this study, Sternberg’s (1988) thinking styles theory, the theory of mental self-government, was chosen to represent intellectual styles because it is a comprehensive intellectual styles model integrating all three styles study approaches put forward by Grigorenko and Sternberg (1995): cognition-centered; personality-centered; and activity-centered. Sternberg’s (1988) theory of mental self-government comprises 13 thinking styles that can be classified into five categories, such as forms and leanings. According to Zhang and Sternberg (2005), these 13 thinking styles can be further re-classified into three types—Type I, Type II, and Type III—which correspond to Type I, Type II, and Type III intellectual styles, respectively.

Type I thinking styles include styles featured by creativity (legislative style), evaluation (judicial), prioritizing one’s tasks (hierarchical), valuing the whole picture (global), and taking new approaches to tasks (liberal). Type II thinking styles emphasize following established rules to perform tasks (executive style), valuing details (local), dealing with tasks one by one (monarchic), and taking traditional approaches to tasks (conservative). Individuals with Type III styles prefer to perform whatever tasks come along (anarchic style), do multiple tasks in spite of priority (oligarchic), focus independence (internal), and focus cooperation (external).

1.4. The present research

Given the above background, the principal objective of this study was to explore how thinking styles related to self-determination. Due to their importance to both thinking styles and self-determination (Shogren et al., 2007; Zhang & Sternberg, 2006), demographic variables were taken into consideration when analyzing the relationships between thinking styles and self-determination.

Based on the literature, the hypothesis that guided the study was that Type I styles are positively related to self-determination, while Type II styles are negatively related to self-determination. Although Type III styles (i.e., the internal, external, oligarchic, and anarchic styles) were expected to be correlated with self-determination, no specific hypothesis regarding the direction of those correlations was made, as the four styles are more situation- and task-dependent. For instance, whether one prefers to work alone (internal style) or with others (external style), one can deal with tasks requiring either Type I or Type II thinking styles. In this study, Type III styles may be considered positively related to self-determination if they manifest features of Type I styles, and negatively related if they manifest features of Type II styles.

The reliability and validity of measures determine whether or not inventories can be adopted in the research. Hence, the psychometric properties of the American Institutes for Research Self-Determination Scale and the Thinking Styles Inventory Revised- II need to be examined before testing the study’s main research question.

2. Methods

2.1. Participants

The participants in this study were from a single university that has recruited a large number of students who are DHH from across the whole country. Most of the participants who are DHH had severe to profound hearing loss (> 81 dB HL). Their major communication mode was both sign and spoken language. In total, 480 students who are DHH and 433 hearing students were selected as participants. Table 1 shows the detailed demographic information for all participants; demographic information specific to students who are DHH such as hearing loss degree and onset of hearing loss, are presented in Table 2.

Table 1
Demographic information regarding students who are DHH and hearing students.

	DHH n/percentage	Hearing n/percentage
Total number of responses	480 (100%)	433 (100%)
University Class Level		
First-year	182 (37.9%)	159 (36.7%)
Second-year	118 (24.6%)	91 (21.0%)
Third-year	162 (33.8%)	135 (31.2%)
Missing	18 (3.8%)	48 (11.1%)
Gender		
Male	224 (46.7%)	86 (19.9%)
Female	255 (53.1%)	338 (78.1%)
Missing	1 (2.1%)	9 (2.1%)

Note. Percentage refers to the ratio of the subgroup of participants (e.g., by university class level) to the total number of participants.

Table 2
Demographic information specific to students who are DHH.

	n/percentage
Total number of responses	480 (100%)
Hearing Loss Degree (dB HL)	
Profound (≥ 91)	205 (42.7%)
Severe (81-90)	186 (38.8%)
Mild to severe (≤ 80)	82 (17.1%)
Missing data	7 (1.5%)
Onset of hearing loss	
Before age 3	256 (53.3%)
After age 3	214 (44.6%)
Missing data	10 (2.1%)
Communication Mode	
Spoken	39 (8.1%)
Sign	183 (38.1%)
Spoken and sign	255 (53.1%)
Missing data	3 (0.6%)
Secondary Schooling	
Deaf	427 (89%)
Hearing	43 (9.0%)
Missing data	10 (2.1%)
Parents' Hearing Status	
Hearing	444 (92.5%)
Deaf/hard of hearing	29 (6.0%)
Missing data	7 (1.5%)
Hearing Aid	
Yes	249 (51.9%)
No	221 (46.0%)
Missing data	10 (2.1%)

Note. Percentage refers to the ratio of the subgroup of participants (e.g., by university class level) to the total number of participants.

2.2. Measures

2.2.1. The American Institutes for Research (AIR) Self-Determination Scale (Wolman et al., 1994)

The AIR is a five-point Likert scale (from 1 = never to 5 = always) with three versions: student, educator, and parent. The present research adopted the student version of AIR, which includes 24 items and two subscales (Opportunity and Capacity). The Capacity subscale consists of questions regarding students' knowledge, ability, and perception of self-determination behaviors. Two sample items are "I know what I need, what I like, and what I'm good at" and "I figure out how to meet my goals. I make plans and decide what I should do." The Opportunity subscale consists of questions regarding the opportunities students have to engage in self-determination behaviors at home and school. Two sample items are "People at school encourage me to start working on my plans right away" and "At home, I have learned how to make plans to meet my goals and to feel good about them." Capacity and Opportunity subscale scores can be calculated, as can an overall self-determination score. Postgraduate students who majored in English were employed to translate and back-translate the AIR Self-Determination Scale between English and Chinese. In this study, the alpha coefficients for Capacity and Opportunity for students who are DHH were .87 and .90, respectively, while those for hearing students were .90 and .87.

2.2.2. The thinking styles inventory-revised II

The Thinking Styles Inventory-Revised II (TSI-R2; Sternberg, Wagner, & Zhang, 2007) is a 65-item measure that includes 13 subscales. It employs a seven-point Likert scale ranging from 1 (does not describe how individuals normally carry out their tasks at all) to 7 (describes so extremely well). Two sample items are “When faced with a problem, I use my own ideas and strategies to solve it.” (Legislative) and “When talking or writing about ideas, I prefer to focus on one idea at a time” (Monarchic).

The TSI-R2 is a modified version of the Thinking Styles Inventory-Revised (TSI-R) (Sternberg, Wagner, & Zhang, 2003) that has been translated and back-translated from the initial English-version TSI through five steps (Zhang, 2007). Both the English and Chinese versions of the TSI-R2 have been demonstrated to be reliable and valid (Fan & Zhang, 2009; Zhang, 2008).

Based on criteria cited by Briggs et al. (2009) (i.e., Cronbach $\alpha > .60$ = acceptable reliability), acceptable reliabilities were obtained in this study. For the students who are DHH, the reliabilities of the 13 subscales ranged from .64 to .84; for the hearing students, they ranged from .64 to .85. The above alpha coefficients are comparable in magnitude with those of previous studies (Zhang, 2009; Zhang, 2008).

2.3. Procedures

Before officially beginning the research, all participants were first required to fill in informed consent forms that emphasized the voluntary nature of their participation and guaranteed all information would remain strictly confidential and be used for research purposes only. Then, a demographic sheet and paper versions of the two aforementioned inventories were distributed to all the participants, who then responded to the inventories in a group. The demographic sheet gathered students' personal information, such as gender and age. Sign language translators were employed to sign the inventories' instructions. The translators also used sign language to explain difficult words and sentences upon request, as the students who are DHH had severe to profound hearing loss (> 81 dB HL), were deficient in verbal language, and the selected inventories, especially the TSI-R2, contain many complex and difficult words and sentences.

2.4. Data analysis

The reliabilities for the two inventories were first estimated using Cronbach's alpha coefficients. Next, confirmatory factor analysis (CFA) was conducted to test the validity of the AIR; however, neither exploratory factor analysis (EFA) nor CFA was conducted for the TSI-R2, for three reasons. First, the AIR has never been examined among Chinese university students especially those students who are DHH, and the sample size was large enough for CFA. Second, both EFA and CFA studies have demonstrated that the TSI-R2 is valid among Chinese university students (Cheng & Zhang, 2014; Fan & Zhang, 2009; Zhang, 2008). Third, validating the TSI-R2 was not the primary interest of this study and results of follow-up multiple regressions could demonstrate the external validity of the TSI-R2 from the AIR. Means and standard deviations for each scale of these two measures are reported in Table 3.

Finally, to predict the AIR from thinking styles, hierarchical multiple regressions were conducted, with all 13 thinking styles entered as predictors and relevant demographic factors (e.g., age and gender) being taken into account. Such multiple regressions were done respectively for hearing and for students who are DHH. “ R^2 ” was adopted as the indicator for effect sizes, with small, medium, and large effect sizes being represented by the values of 0.01, 0.09, and 0.25, respectively (Cohen, 1992).

Table 3

Means (M) and standard deviations (SD) of thinking styles and self-determination among students who are DHH and hearing students.

Scale	DHH		Hearing	
	M	SD	M	SD
Thinking styles				
Legislative	4.66	1.00	4.87	.95
Executive	4.67	1.03	4.84	.98
Judicial	4.47	1.03	4.44	1.11
Global	4.05	.91	4.07	.99
Local	4.43	1.00	4.52	.99
Liberal	4.66	1.10	4.57	1.14
Conservative	4.39	1.01	4.32	1.02
Hierarchical	4.72	1.02	4.80	1.07
Monarchic	4.42	.99	4.42	1.06
Oligarchic	4.47	1.08	4.31	1.10
Anarchic	4.39	1.10	4.31	1.15
Internal	4.30	1.04	4.30	1.09
External	4.77	.99	4.91	1.00
Self determination				
Capacity	40.30	7.67	42.55	8.06
Opportunity	37.20	8.50	41.09	7.90

Table 4
Standardized Parameter Estimates for the Two-Factor Model of Self-determination.

Item	DHH		Hearing	
	Capacity	Opportunity	Capacity	Opportunity
SD1	.42		.66	
SD2	.56		.71	
SD3	.59		.67	
SD4	.67		.68	
SD5	.59		.64	
SD6	.62		.63	
SD7	.54		.61	
SD8	.57		.66	
SD9	.68		.63	
SD10	.67		.58	
SD11	.65		.72	
SD12	.51		.53	
SD13		.49		.55
SD14		.54		.59
SD15		.59		.66
SD16		.58		.53
SD17		.52		.56
SD18		.61		.66
SD19		.63		.67
SD20		.72		.67
SD21		.73		.70
SD22		.78		.62
SD23		.74		.67
SD24		.73		.59

Note: SD = self-determination.

3. Results

3.1. Validities of the AIR among students who are DHH and hearing students

The following model fit indices were obtained through CFA for the two-factor self-determination model: students who are DHH: $\chi^2/df = 2.5$, RMSEA = .06, SRMR = .05, CFI = .93, GFI = .90; hearing students: $\chi^2/df = 2.2$, RMSEA = .05, SRMR = .05, CFI = .93, GFI = .90. The acceptable values for these fit indices are: $\chi^2/df (< 1.50$ to $< .500)$; RMSEA ($< .06$ to $< .10$), SRMR ($< .08$), GFI and CFI (around .90) (Byrne, 1989; Bentler & Bonett, 1980; Browne & Cudeck, 1993; Hu & Bentler, 1999). Thus, the two-factor self-determination model was deemed acceptable for students who are DHH and hearing students. The standardized parameter estimates are presented in Table 4.

3.2. Predicting self-determination from thinking styles

Regression results showed that particular thinking styles made unique contributions to the self-determination scale among students who are DHH and hearing students. As indicated in Table 5, for students who are DHH, Type I style (judicial), Type II styles

Table 5
Predicting self-determination from thinking styles among students who are DHH and hearing students.

	DHH		Hearing	
	Capacity	Opportunity	Capacity	Opportunity
R ² _{total}	.37	.22	.45	.28
R ² _{thinkingstyles}	.37	.22	.45	.28
β _{Style1}	.13 _{jud} *	.20 _{ana} **	.29 _{hie} ***	.15 _{iib} *
β _{Style2}	.24 _{exe} **	–	.21 _{loc} ***	–.16 _{con} *
β _{Style3}	–.18 _{mon} **	–	–.16 _{con} **	.19 _{ana} **
β _{Style4}	.16 _{ana} **	–	.11 _{ana} *	.12 _{ext} *
β _{Style5}	–	–	.17 _{ext} **	–
F	22.67	11.27	27.60	13.90
df	(13,466)	(13,466)	(13, 419)	(13,419)

Note: * p < .05, **p < .01, ***p < .001.

Jud = judicial, exe = executive, mon = monarchic, ana = anarchic, hie = hierarchical, loc = local, con = conservative, ext = external, lib = liberal.

(executive and monarchic), and Type III style (anarchic) style explained 37% of the observed variance in Capacity. Type I judicial style significantly positively predicted Capacity. Type II executive style significantly positively predicted Capacity, while Type II monarchic style significantly negatively predicted Capacity. Type III (anarchic) style significantly positively predicted Capacity and explained 22% of the observed variance therein. Hence, as predicted, Type I style significantly positively predicted self-determination, while Type II style significantly negatively predicted self-determination.

Similarly, for hearing students, as hypothesized, Type I styles (hierarchical and liberal) significantly positively predicted self-determination, while Type II style (conservative) significantly negatively predicted self-determination.

Contrary to the hypothesis, Type II executive style significantly positively predicted Capacity among students who are DHH, while Type II local style significantly positively predicted Capacity among hearing students. As for the Type III styles, which had no previously specified hypothesis, Type III anarchic style significantly positively predicted self-determination among students who are DHH and hearing students, while Type III external style significantly positively predicted self-determination among hearing students.

4. Discussion

Results of this study show that, for both students who are DHH and hearing students, those with Type I styles tended to score higher on the American Institutes for Research (AIR) Self-Determination Scale, while those with Type II tended to be less self-determined, lending support to the hypothesis. It should be noted that regression analysis yielded statistically significant results for only four thinking styles among students who are DHH and six thinking styles among hearing students. These seemingly limited results are nonetheless statistically significant and more likely to be meaningful data than statistical anomalies, for the following three reasons.

First, generally speaking, students with Type I styles had higher and students with Type II styles lower levels of self-determination. Considering that, for university students, being self-determined means facing a number of difficulties and challenges, it is reasonable to identify that individuals with Type I styles (i.e., more creativity-generating, less structured, and cognitively more complex) are better able to deal with these difficulties and challenges, and thus have higher levels of self-determination. For the same reason, those with Type II styles tend to have lower levels of self-determination. However, these interpretations do not indicate a causal relationship between the two constructs. It is equally likely that some individuals' higher levels of self-determination led them to use Type I styles more frequently, while other individuals' lower levels of self-determination led them to adopt Type II styles more often.

Second, as many factors may influence students' self-determination, the explained observed variance (37% and 22% among students who are DHH; 45% and 28% among hearing students) can be perceived as considerable. Per the criteria set by Cohen (1992), effect sizes for these identified relationships were large.

Third, the findings of this study are also in line with those of previous studies, which have demonstrated that Type I intellectual styles are often correlated with more desirable human attributes, and Type II styles with less desirable ones (Betoret, 2007; Cheng et al., 2016; Ingledew et al., 2004).

Researchers may also be interested in how unexpected findings and findings regarding the relationships between Type III styles and self-determination might be interpreted. Regarding unexpected findings, Type II executive style significantly positively predicted Capacity among students who are DHH. One explanation may be that Capacity values implementation, which is consistent with the key features of the executive style. Another possible explanation is that most of these students who are DHH are with severe and profound hearing loss. Type II local style significantly positively predicted Capacity among hearing students. One possible explanation is that Capacity values details, which is in line with the key feature of the local style. Another alternative explanation may be the uneven gender distribution among hearing students.

As for the Type III styles, which had no previously specified hypothesis, Type III anarchic style significantly positively predicted self-determination among students who are DHH and hearing students, while Type III external style significantly positively predicted self-determination among hearing students. The anarchic style is featured by flexibility, echoing the characteristic of self-determination (i.e., live their lives as they choose). The positive relationship between the external style and self-determination is consistent with findings of a previous study indicating extroverted individuals can feel self-determined (Ingledew et al., 2004).

Nevertheless, it should be noted that the aforementioned explanations are merely *post hoc* conjectures, and that this study needs to be replicated. If future studies show similar findings (including especially those unexpected findings), follow-up interviews can be conducted to assist researchers in understanding them.

5. Limitations

The present research has three major limitations. First, the male/female distribution was uneven among hearing students. Second, for various reasons, this study employed senior students majoring in sign language instead of professional or more experienced sign language interpreters when administering the inventories to the students who are DHH, which may have influenced the results. Third, the findings were obtained by examining self-reported data.

These limitations suggest the reported findings should be perceived as exploratory, rather than definitive. Despite these limitations, however, the present data can be seen as meaningful, due to the significance and implications of this study.

6. Significance and implications

The significance of this study manifests in three aspects. First, it has pioneered research efforts at validating, through confirmatory

factor analysis, the American Institutes for Research (AIR) Self-Determination Scale among university students in mainland China. In addition, its findings pertaining to the psychometric properties of the two inventories have enriched the body of data for the TSI-R2 and for the American Institutes for Research (AIR) Self-Determination Scale. Second, by examining the associations between thinking styles and self-determination among two different sociocultural populations, this study supports the contention that intellectual styles are significantly related to self-determination. The validity of this study was strengthened by testing the same relationships among two different samples. Third, this study has made significant contributions to research on self-determination by showing associations between thinking styles and self-determination. Efforts can be made to enhance students' self-determination at university by making use of such associations; detailed examples can be found in the following implications.

Since there are good reasons to believe that the results of this study are meaningful, some practical implications may be proposed for university administrators, teachers, and students. First, university administrators and teachers can use the American Institutes for Research (AIR) Self-Determination Scale to understand the self-determination of university students who are DHH and university hearing students more comprehensively. Second, this study has demonstrated that individuals with Type I styles reported higher levels of self-determination; therefore, university teachers may be able to promote students' self-determination by cultivating Type I (i.e., more creativity-generating, less structured, and cognitively more complex) intellectual styles amongst them. For instance, teachers could assign more tasks requiring creativity or encourage students who are DHH and hearing students to participate in extracurricular activities that are cognitively more complex (consistent with the key features of Type I styles), either of which may help students to enhance their self-determination. Third, the present findings can also help students who are DHH and hearing students understand the associations between intellectual styles and self-determination, which may stimulate them to improve their self-determination by increasing their use of Type I intellectual styles. For example, students may try to approach new things more actively or to obtain additional information to broaden their horizons (in line with the key features of Type I styles), which may help them to increase their self-determination.

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