Current Psychology
https://doi.org/10.1007/s12144-022-03597-8

Thinking styles and their relationship with self-efficacy among deaf and hard-of-hearing adolescent students

Mohammad Ahmed Hammad[1] · **Huda Shaaban Awed**[1]

Accepted: 1 August 2022

Abstract
This study aimed to identify the most common thinking styles of deaf/hard-of-hearing (DHH) and hearing adolescent students, and to examine the extent to which thinking styles predict self-efficacy. It also explored gender-based differences in the thinking styles and self-efficacy of DHH students. Data were collected from 145 DHH and 160 hearing adolescent students in Saudi Arabia (M_{age} = 17.8 years; SD_{age} = 3.57 years) using the Thinking Styles Inventory-Revised II (TSI-R2) and Self-Efficacy Questionnaire for Children (SEQ-C). Findings revealed that the executive, local, conservative, and chaotic thinking styles were more prevalent among DHH students, while the legislative, universal, liberal, and critical thinking styles were more prevalent among hearing students. Those with Type I thinking styles had higher levels of self-efficacy, while those with Type II thinking styles had lower levels of self-efficacy. There were gender-based differences in the self-efficacy of DHH and hearing students, with higher scores observed among females. Further, for DHH students, the Legislative, Liberal, and Internal thinking styles were more prevalent among males rather than females, while the Executive, Hierarchical, Conservative, External, Judicial, and Local thinking styles were more prevalent among females rather than males. For hearing students, males were more likely to exhibit the Liberal, External, and Oligarchic styles, while females were more likely to exhibit the Global, Executive, Conservative, Local, and Hierarchical styles. Together, these findings suggest the need to train DHH students to use positive thinking styles by implementing courses in their school curricula that enable them to reflect on their self-efficacy.

Keywords Thinking Styles · Self-efficacy · Deaf and Hard-of-hearing · Adolescent · Saudi Arabia

Introduction

According to Grigorenko and Sternberg (1995), thinking styles refer to the usual or preferred methods of doing something, which are consistent over long periods and across different activities. This generic term includes cognitive and educational styles, and thinking based on empirical evidence and theoretical concepts. Zhang and Sternberg (2005) proposed a model in which thinking styles were classified into the following three types: Type I styles, which are more creative, less structured, and more cognitive complex; Type II styles, which are more standard-oriented, structured, and cognitive; and Type III styles, which are a combination of Type I and Type II styles. Previous research has shown that thinking styles are critical factors in different aspects of individuals' growth, and that some of these styles are more adaptive in nature, leading to more positive development as compared to other styles (Sagone & De Caroli, 2013; Zhang et al., 2012). A related concept is self-efficacy, which refers to an individual's belief in his/her ability to organize and carry out certain behaviors to produce particular achievements (Bandura, 2013). Deaf/hard-of-hearing (DHH) individuals tend to have low self-efficacy owing to several factors such as the stigma associated with their condition, limited communicative competence, or thinking styles.

Although several studies have implied that thinking styles may influence self-efficacy, few have directly examined the relationships between thinking styles and psychological variables among deaf/hard-of-hearing (DHH) individuals (Cheng & Sin, 2021; Cheng et al. 2016; Fan

✉ Mohammad Ahmed Hammad
hammadeg73@yahoo.com; mahammad@nu.edu.sa

Huda Shaaban Awed
hudaeg2010@yahoo.com; hsawed@nu.edu.sa

[1] Faculty of Education, Najran University, Najran, Saudi Arabia

Published online: 08 September 2022

2016; Hamid et al., 2021; Sagone & De Caroli, 2013). It is important to study this relationship because deaf/hard-of-hearing (DHH) individuals tend to have low self-efficacy owing to several factors such as the stigma associated with their condition and limited communicative competence (Crowe, 2021; Cuevas et al., 2019). To the author's best knowledge, no study has examined the relationship between thinking styles and self-efficacy among DHH individuals in the Arab world, including Saudi Arabia. Further, the lack of knowledge regarding DHH adolescent students (henceforth referred to as students) could be attributed to their perception as a social and cultural minority (Higgins & Lieberman, 2016). Research on the relationship between DHH students' thinking styles and self-efficacy could enable practitioners to develop appropriate interventions to enhance their self-efficacy.

Literature review

Thinking styles

Sternberg (1990) Theory of mental autonomy purports that individuals' methods to negotiate the world around them are an interface between their intelligence and personality. The underlying assumption of this perspective is that, like different governments use different strategies to manage their country's affairs, individuals differ in the way they use their minds to manage their daily activities (Sternberg et al., 2008; Zhang & Sternberg, 2005; Sternberg, 1994) Calls these different methods as "thinking styles."

Sternberg (1988) Also identified 13 different thinking styles, which were originally classified into five categories (e.g., functions and domains). Later, based on additional research evidence and theoretical concepts, thinking styles were reclassified into three types (Type I, Type II, and Type III) (Zhang & Sternberg, 2012). The first type includes Legislative, Judicial, Hierarchical, Global and Liberal styles of thinking, which are characterized by creativity, evaluation, priority, whole picture, and new approaches to tasks, respectively. The second type includes Executive, Local, Monarchic, and Conservative styles of thinking, which are characterized by approaching tasks based on established rules and details, one by one, and traditional methods (Zhang & Sternberg, 2014). The third type consists of Oligarchic, Anarchic, Internal and External thinking styles (Sternberg et al., 2011). The Anarchic and Oligarchic styles emphasize performing tasks that one encounters and multitasking without regard to priority, while the Internal and External thinking styles highlight autonomy and cooperation, respectively (Cheng, 2019).

Several studies have explored the thinking styles of DHH students (e.g., Cheng 2019, 2021; Cheng & Sin, 2021; Cheng et al., 2021; Cheng & Zhang, 2014, 2015, 2017; Cheng et al. 2016; Zhang & Sternberg, 2014). Cheng and Zhang (2014) Reported that the Thinking Styles Inventory-Revised II (TSI-R2, Sternberg et al., 2007) was a reliable and valid tool to assess the thinking styles of DHH students. Further, when applying the TSI-R2, Cheng, Hu, et al. (2016) found that DHH students tended to score significantly lower than their hearing peers on specific Type I (Legislative and Global), Type II (Executive), and Type III (External) thinking styles. Another study found that differences in Type I (Liberal and Hierarchical) and Type II (Executive) styles were significantly influenced by the disability status of DHH and hearing students (Cheng & Deng, 2020).

Self-efficacy

Self-efficacy refers to an individual's beliefs regarding their ability to perform a specific task (Bandura et al., 1999; Meyer et al., 2014). According to Bandura et al. (1999), it is the ability to perform a desired action or adapt to a particular situation, which is the central psychological mechanism employed by humans. Four main sources of information are believed to influence self-efficacy, namely, (1) previous experience in mastering a task, (2) judgment of others' abilities to master the task, (3) feedback from others regarding one's ability to master the task, and (4) physical and emotional reactions to performing a task (Bandura, 2006). In addition, verbal persuasion can improve an individual's self-efficacy (Meyer et al., 2014).

Self-efficacy is believed to be domain-specific, such that a person may have high self-efficacy in one area and low self-efficacy in another (Kelly-Campbell & McMillan, 2015). As such, it is classified into general self-efficacy, social self-efficacy (that pertaining to communicating and interacting with peers, teachers, and those around an individual in different social situations, and expressing his/her opinions well), emotional self-efficacy (pertaining to controlling feelings and suppressing bad thoughts), and academic self-efficacy (that pertaining to completion of academic tasks, such as researching a term paper and passing all subjects) (Çelikkaleli, 2014; Muris, 2001, 2002). Thus, in addition to one's judgment of one's ability to successfully complete a particular task or behavior (Bandura, 1977), self-efficacy includes individuals' beliefs, attitudes, and expectations about themselves and their circumstances in the society (Crowe, 2021).

Historically marginalized groups, such as individuals living with a disability, have been found to internalize negative feelings about their identities, which has a negative impact on their self-esteem, and on other outcomes such as academic performance, mental health, and physical health.

Research on self-efficacy among DHH individuals suggests that they tend to have lower self-efficacy as compared to their hearing counterparts. For instance, on comparing 329 hearing and DHH college students, Dammeyer et al. (2018) found that both DHH students who used a cochlear implant and those who did not had lower self-efficacy scores as compared to hearing students. Further, they attributed this finding to the experience of discrimination. Crowe (2021) suggested that factors such as parental support, strength of social networks, and cultural identity influenced the self-efficacy of DHH individuals. Several studies have systematically documented how self-efficacy beliefs play a significant role in social integration with hearing peers, academic achievement, psychosocial well-being, and quality of life (Bandura, 2013; Bandura et al., 1999; Cuevas et al., 2019; Hintermair, 2008). In an online survey of 114 DHH individuals, Cuevas et al. (2019) reported that those with high self-efficacy believed in their ability to do well in their career and in education, had good social support, and had an internal locus of control. Indeed, the impact of self-efficacy on the development of DHH individuals cannot be underestimated, as self-efficacy plays an important role in their lives, helping them navigate through a myriad of communication challenges (Cuevas et al., 2019).

Relationship between thinking styles and self-efficacy

Previous studies have indicated that Type I and II thinking styles are positively and negatively associated with self-efficacy, respectively. For instance, Fan (2016) examined the relationship of thinking methods with subjective effectiveness in functional decision-making among 926 college students. Findings revealed a positive relationship between creative thinking methods (Type I) and self-efficacy in professional decision-making. However, Fan (2016) did not observe a statistically significant relationship between criteria-compliant thinking styles (Type II) and self-efficacy in professional decision-making. Similarly, Hamid et al. (2021) and Sagone and De Caroli (2013) confirmed the relationship between specific thinking styles and self-efficacy. They reported that Type I and II thinking styles were positively and negatively linked to self-efficacy, respectively. Furthermore, Sarvghad et al. (2011) examined the relationship between thinking styles and self-efficacy among pre-university students in Shiraz, Iran. They utilized Sternberg's thinking style questionnaire and Nezami, Schwartz, and Jerusalem's self-efficacy questionnaire to collect data from a sample of 333 students (217 females and 116 males). Their findings revealed a positive relationship between self-efficacy and all types of thinking styles; except for local and inclusive thinking. Furthermore, they found a relationship between thinking styles and self-efficacy in females, but the same was not observed in males. Finally, based on the findings of a regression analysis, they reported that liberal thinking was a better indicator of self-efficacy than was local thinking.

Self-efficacy also affects the activity type that individuals choose to engage in, the level of their efforts, and their diligence in facing adversity; thus, suggesting a relationship between one's personal ability in conducting a specific task and the concrete perception of the task. Specifically, according to Sarvghad et al. (2011) the more efficient individuals consider themselves in engaging in school, academic, or professional tasks, the more likely they are to apply diverse thinking styles. Relatedly, Cheng et al. (2016) reported that Type I thinking styles were closely linked to self-efficacy indicators. For instance, the capacity to interpret a task is related to one's ability to predict risks and analyze information, which is in turn linked to the ability to make appropriate choices (Hamid et al., 2021).

Considering this relationship between thinking styles and self-efficacy found in studies conducted with the general population, it seems imperative to examine if this relationship exists among DHH individuals as well. However, such research on this population is scarce. Among the few existing studies, Cheng et al. (2016) found that DHH students with Type I thinking styles had a higher level of self-efficacy than did those with Type II styles. This confirms the findings of other studies reported in the preceding section, which reported that Type I and Type II thinking styles were positively and negatively associated with self-efficacy, respectively. In the same context, a study on 225 DHH students found an association between their thinking styles and participation in different activities (Cheng et al., 2021). Specifically, students with Type I styles (i.e., more creative, less structured, and more cognitively complex styles) exhibited higher levels of student participation as compared to their counterparts with Type II styles (i.e., more criteria-preferred, structured, and cognitively simple styles). Further, Cheng and Deng (2020) found that DHH students' thinking styles are also related to institutional integration and its impact on the level of academic performance. Specifically, in their study comprising 657 DHH students, they found that, as compared to students with Type II thinking styles, those with Type I thinking styles tended to be more integrated, which in turn had a positive effect on their academic performance.

The present study

Based on the above literature and the lack thereof in the Saudi context, the present study aimed to identify the common thinking styles of DHH and hearing students. Further,

Table 1 Demographic characteristics of the study participants

Demographic Characteristics		DHH Students (n = 145) *f* (%)	Hearing Students (n = 160) *f* (%)
Grade	Tenth	42 (28.96%)	43 (26.87%)
	Eleventh	47 (32.41%)	56 (35%)
	Twelfth	56 (38.62%)	61 (38.12%)
Gender	Male	83 (64.13%)	87 (54.37%)
	Female	62 (42.75%)	73 (45.62%)
Onset of hearing loss	Before the age of 3 years	101 (69.65%)	-
	After the age of 3 years	36 (24.82%)	-
	Missing	8 (5.51%)	-
Degree of hearing loss (dB HL)	Profound (≥ 91)	53 (36.55%)	-
	Severe (81–90)	49 (33.79%)	-
	Mild to severe (≤ 80)	43 (29.65%)	-
Parents' hearing status	Hearing	112 (77.24%)	-
	DHH	24 (16.55%)	-
	Missing	9 (6.20%)	

Note: DHH = Deaf/Hard-of-hearing

it aimed to examine the role of thinking styles in predicting the self-efficacy of DHH and hearing students in Saudi Arabia. In this regard, based on extant literature (Cheng, 2019; Cheng, Hu, et al., 2016; Fan 2016), it was hypothesized that Type I and II thinking styles would be positively and negatively linked to self-efficacy, respectively. This hypothesis was based on the three-dimensional model of thinking styles proposed by Zhang and Sternberg (2005). According to this model, Type I thinking styles are often associated with positive personality traits, while Type II thinking styles are often associated with negative personality traits.

The present study thus explored the following research questions:

1. What are the most common thinking styles of DHH and hearing students?
2. Do thinking styles predict self-efficacy in DHH and hearing students?
3. Do the thinking styles and self-efficacy differ in male and female in DHH and hearing students?

Methodology

Participants

The present sample included 145 DHH students and 160 hearing students aged 16–19 years (mean age of DHH students: M = 17.8 years, SD = 3.57 years; mean age of hearing students: M = 17.3 years, SD = 3.81 years). DHH students registered in integration programs in secondary schools were recruited from the cities of Najran, Asir, and Jazan in the south of the Kingdom of Saudi Arabia. Most of the DHH participants had severe to profound hearing loss (> 81 dB HL); their hearing level was verified based on formal school reports. None of the students had any other disabilities. They communicated through sign language and spoken language. No information regarding other forms of disabilities or cochlear implants was sought from the selected DHH students. To ensure that DHH and hearing students had similar demographic backgrounds, hearing students were recruited from public schools where DHH student programs were offered. Table 1 presents the detailed demographic information for both groups of participants.

Data Collection

Measures

Data were collected using the Self-Efficacy Questionnaire for Children (SEQ-C; Muris 2001) and (TSI-R2; Sternberg et al., 2007).

Thinking Styles Inventory-Revised (TSI-R2; Sternberg et al., 2007). The TSI-R2 is the revised version of the Thinking Styles Inventory-Revised (TSI-R; Sternberg et al., 2003), which was in turn developed from the original Thinking Styles Inventory (Sternberg, 1992). It is used to assess the 13 thinking styles identified in Sternberg's theory (Zhang & Sternberg, 2000). Respondents rate each item on a 7-point Likert scale in terms of whether it represents the way they usually perform their tasks, with 1–7 responses representing "not at all" to "very well."

Previous studies applying the TSI-R2 have confirmed its internal consistency (with a Cronbach's alpha above 0.60) and extrinsic validity (by comparing this measure of thinking styles with other relevant constructs such as emotion and anxiety) (Zhang, 2008, 2009). In keeping with Briggs et al. (2009) recommendation that a Cronbach's $\alpha > 0.60$ represents acceptable reliability, the Cronbach's α for all thinking styles ranged from 0.62 to 0.75 (Fan, 2016). When used with DHH participants, the Cronbach's α of the 13 subscales ranged from 0.61 to 0.85, with an average value of 0.71. With hearing students, the Cronbach's α ranged from 0.54 to 0.81, with an average value of 0.72 (Cheng & Sin, 2021). In the present study, the Cronbach's α for all the 13 scales of the Arabic version ranged from 0.67 to 0.79 for DHH students and 0.67 to 0.81 for hearing students. These results are consistent with those reported in several previous

studies (Cheng & Deng, 2020; Cheng et al. 2016; Sagone & De Caroli 2013).

Self-Efficacy Questionnaire for Children (SEQ-C; Muris 2001). The 24-item SEQ-C (Muris, 2001) was created in Dutch, based on the Principals' Sense of Efficacy Scale by Bandura et al. (1999). It aims to measure adolescents' beliefs about their social, academic, and emotional competencies. It contains 24 items across the following three subscales: (1) academic self-efficacy (ASE), (2) social self-efficacy (SSE), and (3) emotional self-efficacy (ESE). Each item is rated on a 5-point Likert scale ranging from 1 (not at all) to 5 (very good). The tool is designed to provide a score on each sub-scale as well as a global self-efficacy score. The SEQ-C was first validated with 330 Dutch adolescents aged 14–17 years. An exploratory factor analysis (EFA) revealed the presence of three factors accounting for 56.7% of the total variance. Correlations between the three factors ranged from 0.17 (social and academic self-efficacy) to 0.41 (emotional and academic self-efficacy). Later, the SEQ-C was tested with 596 Belgian students aged 12–19 years (Muris, 2002). Several studies have confirmed the high reliability, stability, and construct validity of the SEQ-C with the general adolescent population (Andretta & McKay, 2020; Greco, 2021; Habibi et al., 2014; Minter & Pritzker, 2017; Tan & Chellappan, 2018) and DHH adolescents (Bolívar-Cruz et al., 2018; Evans, 2021). In the present study, the Cronbach's α for all the three subscales was above 0.81 for both DHH and hearing students.

For use in the present study, the TSI-R2 and SEQ-C were translated from English to Arabic and then back-translated to English by language experts, to ensure that the Arabic translation maintained the same meaning as the original questionnaire. First, the English version was translated into Arabic by a Arabic–English bilingual professor from the Department of English at the researchers' institution. The Arabic version was then back-translated into English by another professor who specializes in English and whose first language is Arabic. Subsequently, the translated Arabic and English versions of the scale were reviewed by three specialists majoring in Arabic, psychology, and English, respectively. Based on the consensus among the three specialists, some words and items were revised to create the final Arabic version of the two tools. Hearing students validated whether the instructions and items of the questionnaire were clear and easy to understand. For the DHH students, the questionnaire instructions and items were also translated into sign language, which was often their preferred mode of communication. Three teachers who worked with DHH students were employed to administer the questionnaires. They were fluent in sign language and had several daily interactions with the DHH participants. The researchers conducted a brief 40-minute training to explain terms such as thinking styles and self-efficacy to these sign language teachers, to enable them to communicate their meaning effectively to DHH students. Subsequently, the teachers were asked to read through the questionnaires, and the researchers and teachers came to an agreement on how to translate them into sign language.

It should be noted that the two questionnaires differed in terms of the difficulty level of the vocabulary used. Specifically, the SEQ-C (Muris, 2001) contains simply-worded questions such as "How well can you work in harmony with your classmates?" and "How well can you control your feelings?". In contrast, the TSI-R2 includes several abstract words such as "Brainstorming" and "routine," and complex sentences such as "When talking or writing about ideas, I prefer to focus on one idea at a time." As DHH individuals are known to experience difficulties with verbal language, prior to the administration of the TSI-R2 with DHH students, an exploratory interview was conducted with nine DHH students with different levels of language ability. They were asked to point out difficult words and items, and to suggest easier alternatives. These opinions were later incorporated by the researchers and specialists who translated the scale from English to Arabic.

Data collection procedure

Data were collected from March to April 2021. Prior to data collection, all participants completed informed consent forms that highlighted that their participation was voluntary, that all information obtained would be kept strictly confidential, and that the data would only be used for research purposes. Before its commencement, the study received ethical approval from the Deanship of Scientific Research at Najran University, and the Special Education Department of the Education Department. All students visited special education centers for the data collection because schools were closed during the study period due to the COVID-19 pandemic. The questionnaires were administered collectively for all DHH students, in a room at the center. The same procedure was followed for hearing students. The data collection procedure took 75 min, following which students received a small gift as a token of appreciation for their participation.

Data Analysis

All statistical analyses were conducted using SPSS version 20. The reliability of the two scales were confirmed by computing Cronbach's α coefficients because these tools had not been used before in the Saudi context on a sample of DHH students. In addition, descriptive statistics were computed for the thinking styles, and the data distribution was

Table 2 Descriptive statistics on thinking styles of DHH and hearing students

Thinking styles	DHH Students				Hearing Students			
	M	SD	Skewness	Kurtosis	M	SD	Skewness	Kurtosis
Legislative	21.21	6.20	−0.46	−0.28	23.79	6.9	−0.64	−0.47
Executive	21.97	5.88	−0.39	−0.24	17.96	8.26	0.14	−0.30
Judicial	20.25	6.12	0.17	−0.26	18.66	5.64	0.27	−0.18
Global	20.19	6.12	−0.011	0.05	21.59	4.96	−0.24	0.72
Local	21.83	6.28	−0.39	−0.21	22.91	5.91	−0.41	−0.78
Liberal	18.93	5.94	−0.08	−0.68	22.63	6.11	−0.21	−0.34
Conservative	23.29	5.46	−0.21	−0.45	21.29	7.21	−0.18	−0.41
Hierarchical	22.73	6.09	0.04	−0.31	23.71	6.02	−0.12	−0.51
Monarchic	22.71	5.42	0.34	0.52	25.49	6.88	−0.19	-0.27
Oligarchic	22.68	7.02	−0.27	−0.24	25.67	7.02	-0.64	−0.11
Anarchic	21.19	6.02	−0.16	-0.29	22.97	5.68	−0.21	−0.53
Internal	20.03	5.99	−0.18	0.03	20.66	8.96	−0.23	−0.61
External	23.63	7.26	−0.49	−0.44	19.98	8.87	−0.08	−0.35

Note: DHH = Deaf/Hard-of-hearing

examined based on skewness and kurtosis. The chi-square test was used to compare students with low, medium, and high scores on each thinking style. This analysis was conducted within the DHH and hearing students' groups. In addition, multiple regressions were performed to examine if thinking styles predicted students' self-efficacy, while controlling for relevant demographic factors. Specifically, these regressions were performed separately for the hearing and DHH students, with each of the 13 thinking styles as predictive variables. "R^2" was adopted as an indicator of effect size, with small, medium and large effect sizes being represented by values of 0.01, 0.09 and 0.25, respectively (Cohen, 1992). Finally, means, standard deviations, and the t-test were used to examine the gender differences in the thinking styles and self-efficacy of DHH students.

Results

As mentioned in the previous section, the distribution of the data was first examined using skewness and kurtosis. Table 2 presents these findings along with the means and standard deviations of the two student groups on each thinking style.

In addition, the chi-square test was used to compare students with low, medium, and high scores on each thinking style, withing the DHH and hearing groups. As evident from in Table 3, the percentages of prevalence of styles among the DHH and hearing students differed significantly. Specifically, the Executive, Local, Conservative, and Anarchist styles were most prevalent among DHH students (significance levels of 0.00, 0.01, 0.03, and 0.00, respectively), while the Legislative, Global, Liberal, and Judicial styles were more prevalent among hearing students (significance levels of 0.03, 0.02, 0.00, and 0.00, respectively).

Multiple regression analyses were conducted to determine if thinking styles predicted self-efficacy, after controlling for gender and grade level. As evident from Table 4, thinking styles were significant predictors of self-efficacy in both student groups. Further, specific thinking styles predicted specific types of self-efficacy. In DHH students, Legislative and Hierarchical thinking styles (both Type I styles), and the Internal thinking style (a Type III style) explained 27% of the observed variance in academic self-efficacy. In addition, Legislative and Monarchic styles (both Type I) and the Internal style (Type III) accounted for 21% of the observed variance in social self-efficacy. The Legislative (Type I) and Internal styles (Type III) were positive predictors of social self-efficacy, while the Monarchic style (Type I) was a negative predictor of social self-efficacy. Finally, the Judiciary style (Type I) was a positive predictor of emotional self-efficacy, explaining 28% of its variance. Similarly, for hearing students, three sets of unique contributions by particular thinking styles to the self-efficacy subscales were noted. Liberal and Judicial thinking styles (both Type I styles), and the Anarchic thinking style (a Type III style) explained 19% of the observed variance in academic self-efficacy. In addition, Hierarchical and Liberal styles (both Type I) and the internal style (Type III) accounted for 22% of the observed variance in social self-efficacy. Finally, The Executive and Hierarchical (Type I), and Conservative (Type II) were positive predictors of emotional self-efficacy.

Table 4. Multiple regression analysis for predicting self-efficacy based on DHH and hearing students' thinking styles, controlling for grade and gender.

Thinking styles: LEG = Legislative; EXE = Executive; JUD = Judicial; GLO = Global; LOC = Local; LIB = Liberal; CON = Conservative; HIE = Hierarchical; MON = Monarchic; OLI = Oligarchic; ANA = Anarchic; INT = Internal; EXT = External.

Table 3 Distribution and comparison of low, medium, and high thinking styles among DHH and hearing students

Thinking styles	DHH Students			Hearing Students				
	Low	Medium	High	Low	Medium	High	X^2 (df = 2)	*P value*
Legislative	29.6%	66.02%	4.2%	6.09%	72.54%	21.37%	0.74	0.04
Executive	14.8%	76.05%	9.06%	28.7%	63.9%	7.4%	9.82	0.00
Judicial	29.06%	64.8%	6.14%	16.5%	71.9%	11.6%	1.48	0.00
Global	22.9%	65.8%	11.3%	6.5%	80.6%	12.9%	7.37	0.02
Local	7.9%	86.01%	6.09%	28.7%	65.4%	5.9%	3.79	0.01
Liberal	27.8%	62.9%	9.3%	14.9%	69.8%	15.3%	1.80	0.00
Conservative	13.6%	74.5%	11.9%	29.6%	66.6%	3.8%	17.96	0.00
Hierarchical	15.9%	73.8%	10.3%	13.9%	71.6%	14.5%	1.78	0.41
Monarchic	14.5%	78.9%	6.7%	14.9%	75.8%	9.3%	1.41	0.71
Oligarchic	13.8%	77.8%	8.4%	13.7%	73.5%	12.8%	0.79	0.65
Anarchic	11.9%	76.43%	11.67%	28.6%	63.8%	7.6%	2.37	0.03
Internal	14.7%	78.2%	7.1%	16.9%	76.2%	6.9%	4.56	0.73
External	16.8%	77.02%	6.18%	22.5%	68.4%	9.1%	3.42	0.17

Note: DHH = Deaf/Hard-of-hearing

Table 4 Multiple regression analysis for predicting self-efficacy based on DHH and hearing students' thinking styles, controlling for grade and gender

	ASE	SSE	ESE
DHH students			
R^2_{total}	0.26	0.21	0.28
$R^2_{grad+gender}$	0.00	0.2	0.000
$R^2_{thinking\ style}$	0.27	0.21	0.28
$\beta_{Style\ 1}$	0.16_{HIE}^{*}	0.18_{LEG}^{*}	0.19_{JUD}^{*}
$\beta_{Style\ 2}$	0.19_{LEG}^{*}	-0.19_{MON}^{*}	-0.16_{MON}^{*}
$\beta_{Style\ 3}$	-0.21_{INT}^{*}	0.18_{EXT}^{*}	-
F	11.29	9.64^{**}	9.75^{**}
df	15.43	15.44	15.44
Hearing students			
R^2_{total}	0.19	0.22	0.15
$R^2_{grad+gender}$	0.01	0.01	0.02
$R^2_{thinking\ style}$	0.17	0.18	0.13
$\beta_{Style\ 1}$	0.24_{LIB}^{**}	0.22_{HIE}^{*}	0.27_{EXT}^{**}
$\beta_{Style\ 2}$	0.20_{JUD}^{**}	0.17_{LIB}^{*}	0.21_{CON}^{**}
$\beta_{Style\ 3}$	0.18_{ANA}	0.19_{INT}	0.22_{HIE}^{**}
F	8.94^{**}	9.95^{**}	7.03^{**}
df	13.05	13.05	13.05

Note. DHH = Deaf/Hard-of-hearing

ASE = Academic Self-Efficacy; SSE = Social Self-Efficacy; ESE = Emotional Self-Efficacy.

$N = 179$, * $p < .05$ ** $p < .01$.

The last part of the analysis involved an examination of the means, standard deviations, and t-statistic to determine gender-based differences in the thinking styles and self-efficacy of DHH students. These findings are presented in Table 5.

As compared to females, males in DHH students were more likely to exhibit the Legislative, Liberal, and Internal styles. In contrast, as compared to males, females were more likely to exhibit the Global, Executive, Judicial, Local, Conservative, and Hierarchical styles, and they had higher scores on social, academic, and emotional self-efficacy. No gender-based differences were observed in the Monarchic, Oligarchic, External, and Anarchic thinking styles. Similarly, for hearing students, As compared to females, males in hearing students were more likely to exhibit the Liberal, External, and Oligarchic styles. In contrast, as compared to males, females were more likely to exhibit the Global, Executive, Conservative, Local, and Hierarchical styles, and they had higher scores on academic and emotional self-efficacy. No gender-based differences were observed in the Legislative, Judicial, Monarchic, Anarchic, and Internal thinking styles. In addition, no gender-based differences were observed in Social self-efficacy.

Discussion

The principal objective of this study was to identify the characteristic thinking styles of DHH and hearing students, and to investigate whether thinking styles predict self-efficacy. This study was the first to examine these issues in a sample of DHH and hearing adolescent students in the Kingdom of Saudi Arabia by taking their demographic variables into consideration. Additionally, this study aimed to examine gender-based differences in the thinking styles and self-efficacy of DHH students. To that end, Arabic versions of the TSI-R2 and SEQ-C were first created and validated. All data were collected using these translated tools. The results showed that the Executive, Local, Conservative, and Anarchic thinking styles were more prevalent among DHH students, while the Legislative, Global, Liberal, and Judicial styles were more prevalent among hearing students. In addition, students with Type I thinking styles exhibited higher

Table 5 Means (M), standard deviations (SD), and t values for thinking styles and self-efficacy among DHH students

	DHH Students			Hearing students		
Scales	Male	Female	T	Male	Female	T
	M (SD)	M (SD)		M (SD)	M (SD)	
Thinking styles						
Legislative	26.45 (6.32)	15.22(5.47)	13.54**	23.52(3.60)	24.32(4.28)	1.24
Executive	14.25(5.12)	25.41(5.75)	16.25**	15.83(4.18)	18.66(4.84)	5.36**
Judicial	13.29(4.89)	25.38(4.57)	18.47**	21.02(4.86)	21.42(3.31)	0.61
Global	19.21(5.24)	21.02(5.21)	4.31**	18.31(3.96)	20.33(4.29)	4.61**
Local	18.47(6.67)	22.94(5.19)	8.42**	17.83(4.42)	20.46(4.96)	5.08**
Liberal	25.02(5.29)	20.97(6.87)	3.87**	23.56(4.12)	19.71(4.53)	5.90**
Conservative	20.14(6.89)	24.06(5.57)	3.79**	21.08(4.57)	22.53(4.82)	2.55*
Hierarchical	15.92(5.94)	18.59(4.95)	5.32**	22.73(4.52)	24.81(4.09)	3.87**
Monarchic	23.52(5.47)	24.02(7.55)	0.86	25.42(4.25)	25.22(4.91)	0.33
Oligarchic	25.20(6.98)	25.60(6.24)	0.54	26.81(4.42)	24.73(3.97)	3.87**
Anarchic	22.91(5.48)	23.82(5.27)	1.05	23.52(4.81)	24.14(5.42)	1.13
Internal	26.74(6.17)	19.34(5.45)	5.74**	19.01(4.21)	20.08(4.88)	1.86
External	22.71(6.15)	23.19(5.85)	1.12	21.42(3.26)	19.51(3.71)	4.48**
Self-Efficacy						
Social self-efficacy	26.21(4.57)	28.76(4.59)	3.25**	32.38(3.21)	31.93(3.59)	0.98
Academic self-efficacy	23.43(4.11)	28.28(4.24)	7.26**	25.84(4.27)	30.67(3.70)	7.53**
Emotional self-efficacy	22.06 (4.98)	26.05(4.65)	5.20**	26.34(4.39)	30.82(3.27)	7.17**

Note: DHH = Deaf/Hard-of-hearing. *p < .05, **p < .01

levels of self-efficacy, while those with Type II thinking styles had lower levels of self-efficacy. Furthermore, significant gender-based differences were observed in the thinking styles and self-efficacy of DHH students.

With reference to the typical thinking styles of DHH and hearing students, the present results corroborate those of several previous studies (e.g., Cheng & Deng, 2020; Cheng & Zhang, 2017; Cheng et al., 2016), which reported that DHH students exhibited significantly lower scores than hearing students when tested on Type I thinking styles (Global, Legislative, Liberal, and Judicial). In contrast, hearing students tended to exhibit significantly lower scores than their DHH counterparts when tested on Type II (Executive, Local, and Conservative) and Type III (Anarchic) styles. Furthermore, Cheng and Deng (2020) reported that hearing students tended to use Type I thinking styles (more creativity-generating, less structured, and more cognitively complex styles) more often, and Type II thinking styles (more favorable to standards, more structured, and more cognitively simple styles) less often. In contrast, DHH students exhibited a high use of both Type II thinking styles (Cheng & Deng, 2020).

These findings may be explained by the fact that Type I thinking styles represent complex cognitive skills such as the ability to plan, set goals, open-mindedness, having a holistic view of things, and freedom from strict traditional rules. DHH students may lack such skills owing to their condition, the educational environment, and the need to following specific instructions, all of which require them to use traditional methods when tackling related tasks (Zhang & Sternberg, 2014). In comparison, Type II and III thinking styles require a lower level of cognitive complexity and complex mental abilities. Therefore, DHH students may be more likely to use these styles instead. This was confirmed by several previous studies (Antia et al., 2011; Cheng & Deng, 2020; Cheng et al., 2016; Ofsted, 2012; Zhang & Sternberg, 2014). Interestingly, the present study did not reveal significant differences in the prevalence of the Internal, Monarchic, Oligarchic, External, and Hierarchical thinking styles. This may be because most of these styles are of a personal and emotional nature, and they are mostly related to the individual's connection with others. As they are often used in social situations, they are flexible styles that are influenced by the nature of circumstances and stimuli surrounding these students (Cheng & Zhang, 2015).

With reference to the ability of thinking styles to predict self-efficacy, again, the present results were consistent with those of several previous studies that reported that Type I and Type II thinking styles were respectively positively and negatively associated with self-efficacy (e.g., Cheng et al. 2016; Diseth 2011; Phan, 2007). Similarly, the present findings confirm Fan's (2016) results, which revealed the positive influence of Type I thinking styles on self-efficacy. It is not surprising to find consistent patterns in the relationship between thinking styles and self-efficacy among DHH and hearing students because previous studies have shown that Type I thinking styles often correlate with more desirable human traits, and that Type II styles correlate with less desirable patterns (Cheng et al. 2016), student participation (Cheng et al., 2021), integration (Cheng & Deng, 2020),

self-efficacy (Cheng et al., 2016), and quality of life (Cheng & Zhang, 2017) among university students. It is noteworthy that, within all these studies, relevant demographic variables were taken into account, especially among DHH students.

The results of the present multiple regression analysis yielded significant results for only six thinking styles among DHH students and five among hearing students. These results may seem limited but they are noteworthy for two reasons. First, the results for both DHH and hearing students indicate that those who tend to use Type I thinking styles have higher levels of self-efficacy, while those who tend to use Type II thinking styles have lower levels of self-efficacy. However, it may also be more likely that students with a high level of self-efficacy tend to use Type I thinking styles more often, while those with low self-efficacy tend to use Type II thinking patterns more often. Second, the maximum variance explained by the thinking styles was only about 29% for DHH students and 21% for hearing students, indicating that it is imperative to consider the unique contribution of each thinking style in predicting self-efficacy.

With reference to gender-based differences in the thinking styles and self-efficacy of DHH students, this study revealed that the Legislative, Liberal, and Internal styles were more prevalent among males rather than females, while the Executive, Conservative, Hierarchical, Judicial, and Local styles were more prevalent among females rather than males. Further, females exhibited higher scores on all three self-efficacy scales as compared to males. For hearing students, as compared to females, males in hearing students were more likely to exhibit the Liberal, External, and Oligarchic styles. In contrast, as compared to males, females were more likely to exhibit the Global, Executive, Conservative, Local, and Hierarchical styles. In addition, females exhibited higher scores on academic and emotional self-efficacy. These differences can be explained in the light of the social learning theory (Walters & Lowenkamp, 2016), which suggests that thinking styles and personalities of males and females differ owing to differences in their upbringing and social roles. This is true in the Arab society, especially in Saudi Arabia. As compared to boys, girls spend longer periods at home, which may render them more capable of dealing with daily problems through interactions with parents. Further, such an upbringing exposes them to a variety of emotional, social, cognitive, and behavioral experiences, which could explain their expertise in evaluating situations effectively. However, this upbringing also places restrictions on girls, where they are required to adhere to social standards. Evidently, this would lead them to assume a conservative stance based on family standards. This also explains their commitment to preserving or conforming to the prevailing culture of the society, managing their emotions in a socially acceptable manner, and preparing for their future role as a wife and mother. These societal influences also affect males because they are expected to assume the responsibility of others since childhood. The father or head of the household often participates in making decisions and bears the burdens of life (Hamdan, 2005). This may explain why males tended to exhibit Libertarian and Legislative styles more often, while females tended to exhibit the Conservative and Executive styles more often.

These findings on self-efficacy need to be interpreted based on the Saudi culture, particularly the Deaf culture in Saudi Arabia. It is well-established that self-efficacy is also influenced by several social and cultural factors such as individuals' hearing status or severity of condition, parents' hearing status, type of school attended, communication mode used at home and in school, and group identification (Bat-Chava, 1993; Cuevas et al., 2019; Dammeyer et al., 2018). The term "Deaf culture" pertains to the shared beliefs, customs, communication methods, social norms, and identity of deaf individuals (Holcomb, 2013; Leigh et al., 2018). For young students, identification with and participation in the Deaf culture, which generally occurs in the context of residential schools and Deaf clubs (Holcomb, 2013); enable DHH adolescents to better negotiate social expectations and perceptions (including discrimination and stigma); overcome communication limitations, and develop a sense of self by interacting with other deaf individuals such as peers and teachers (Leigh et al., 2018). However, adolescents in KSA have very limited opportunities to participate in the Deaf culture due to several reasons.

Alofi et al. (2019) note that one of the primary reasons for this is that there are few deaf families with deaf children in KSA. As most of the deaf children have hearing families, the latter rarely have knowledge of or exposure to the Deaf culture and language. Additionally, the masses tend to hold a medical rather than socio-cultural perspective about deaf individuals (Alamri, 2017; Alqarni, 2017). As a result, there is a substantial lack of awareness of the needs of DHH individuals (Alomary, 2014). Nevertheless, it is important to note that the overall acceptance, well-being, and socialization level of DHH individuals in KSA were found to be positive (Al-Shammari et al., 2014). Second, deaf education is a relative new field, with special schools emerging only in the 1960s (Alzahrani, 2020). With more than 15 deaf schools in KSA presently, it is important to note that none of these schools have deaf teachers, administrators, and staff, which further limits DHH students' access to deaf professionals and deaf role models (Alofi et al., 2019). Thus, in KSA, Deaf clubs represent one of the very few contexts in which DHH individuals can express and develop their Deaf identity (Alofi et al., 2019). However, only individuals aged over 18 years are allowed to participate in these clubs (Saudi Deaf Sports Federation, 2017). As such, younger

DHH individuals, like those who participated in the present study, rarely have opportunities to engage in the Deaf culture exclusively. Holcomb (2013) highlights that residential schools and Deaf clubs are the primary source of exposure to the Deaf culture in most contexts (Holcomb, 2013). Therefore, it is evident that the sense of self of DHH adolescents in KSA may be negatively influenced by these limitations in exposure to Deaf culture (Alofi et al., 2019).

Furthermore, being brought up with limited exposure to Deaf culture, denial of their Deaf identity, and being socialized as a minority among hearing individuals could mean that these students may have internalized the social prejudices against DHH people. An important aspect to consider when interpreting the present findings is the role of internalized oppression in DHH students' self-efficacy, and thereby, in the relationship between thinking styles and self-efficacy. Internalized oppression entails acceptance of the social view that one is of inferior status (which often translates to self-hatred) owing to the historical oppression and devaluation of minority groups (David, 2013). While it has been researched extensively in marginalized groups such as women and racial minorities, the effects of systemic exclusion of individuals living with disabilities from social, economic, and political spheres is relatively underacknowledged (Ladd & Lane, 2013).

Disability prejudice is a pervasive social reality; there is an unspoken expectation of "compulsory ablebodiedness," in that individuals who do not fit social definitions of normalcy, physical ability, health are expected to do their best to achieve the closest approximation of normalcy (McRuer, 2006). The process of socialization that individuals who do not fit into these social definitions of normalcy undergo, particularly in a society that devalues disability, colors their own sense of self owing to the constant awareness and evident reminders of their perceived marginal position in the society (Watermeyer & Swartz, 2008). By and large, even in so-called developed societies, the majority worldview perpetuates ableism through media, social and public health policy, welfare activities, and social institutions such as educational institutions (Goodley, 2014). Further, the inherent yet largely unconscious disability prejudice is evident from the fact that the physical environment, leisure amenities, technology, etc., are structured keeping in mind individuals who fit the socially determined definition of "ablebodiedness" (Watermeyer & Gorgens, 2013) For instance, Hodge and Runswick-Cole (2013) demonstrated how young children with disabilities experienced ableism even during seemingly unbiased leisure activities. Consequently, individuals who do not fit this social definition of ablebodiedness constantly experience alienation and a lack of sense of belongingness. Furthermore, as emphasized by Watermeyer and Gorgens (2013), "the disabled identity carries emotive prejudices, associating its bearers with ideas of lack, frailty, shame, dependency, and rejection" and it inherently involves rejecting and hating one's sense of self in an attempt to conform to the socially-accepted image (Leigh, 2009). Further, they grow up with the belief that their limited physical abilities make participation in society unreasonable or impossible, and therefore, they quietly accept various forms and levels of bias and discrimination. This internalized oppression also translates to poor self-worth and low achievement (Watermeyer & Gorgens, 2013), further perpetuating the vicious cycle of alienation, dependency, and denied rights.

While there is little related research on individuals with disability, findings from other marginalized groups such as women, racial minorities, indigenous people, and sexual minorities suggest that internalized oppression translates to low achievement levels, poor self-efficacy (including self-hatred, constantly trying to fit in with the idealized image), lack of agency, increased criminality, mental illnesses, and several other such negative and damaging manifestations (Bailey et al., 2013; Bearman & Amrhein, 2013; Hipolito-Delgado et al., 2013; Liebow, 2016; Nadal et al., 2021).

Similar effects have been found on individuals with disabilities. For instance, a recent qualitative study of young individuals with different disabilities revealed the negative effects of internalized ableism on the identity, health, and wellbeing of the participants (Jóhannsdóttir et al., 2022). Relatedly, a study on postsecondary students from a large public university in the US found that perceived stereotype based on ableist attitudes influenced students' persistence intentions, and this relationship was mediated by their academic self-efficacy (Lotz, 2021). The author suggests that this finding explains the high attrition rates among individuals with disability in postsecondary education. Similarly, using the socio-cognitive framework, Gibbons et al. (2015) qualitatively analyzed interviews of students with intellectual disability. They found the attributions related to the social bias against individuals with disability, lack of access to social support, and ambivalent identities negatively influenced the participants' motivation to pursue higher studies and career development (Gibbons et al., 2015). These findings suggest that internalized oppression and the experience of systemic discrimination and bias would be an important determinant of the low self-efficacy event among DHH students. This effect may be particularly pronounced for DHH students from regular schools, as was the case with students comprising the DHH group in the present study, because the hearing population's social attitudes and stereotypes influence deaf individuals' identity development (Farber, 2015). Accordingly, the present findings on the effect of thinking styles on self-efficacy may have been influenced by the poor self-efficacy of these students to begin with. However, the extent of this effect on the present participants' self-efficacy

is unclear because exposure to the Deaf culture, or their self-efficacy beliefs in the context of internalized oppression or their experience of ableism were not included in the variables studied or controlled for in the present study. This point has been discussed further in the later section on the limitations of the present study.

Furthermore, considering the relationship between thinking styles and self-efficacy, it is understandable that the present study revealed that DHH students tended to use Type II thinking styles more often, and that those predominantly exhibiting this thinking style also had lower self-efficacy across DHH and hearing students. When considering the above discussion on compulsory ablebodiedness and internalized oppression, and their resultant effect of having DHH individuals constantly attempt to achieve "normalcy" or the idealized social image, we conjecture that this need to "fit in" may also explain the conservative and rule-abiding characteristics that accompany the Type II thinking style exhibited by the DHH students in the present study. However, it is important to note that this speculation is yet to be researched.

With reference to gender differences in self-efficacy, however, both genders exhibited unique characteristics. Specifically, female DHH students exhibited higher self-efficacy scores on all three sub-scales as compared to their male counterparts. In addition, females in hearing students exhibited higher scores on academic and emotional self-efficacy. This may be due to the fact that fathers often use emotional words with their female children rather than males. Further, they often engage with them in discussions about their emotional state, which contributes to the development of higher emotional intelligence among girls (Goleman et al., 2012). Culturally, in Saudi, females tend to be more committed to studying, and this may be particularly true for DHH females as they try to compensate for the difficulties caused by their condition. Females are also less active and aggressive than males; due to which they may be appreciated and respected by their teachers. Together, these experiences would lead to higher self-efficacy and self-esteem among females. In contrast, Saudi DHH males may be constantly under the pressure to prove themselves and to compensate for difficulties caused by their condition by being active. Consequently, they are also more likely to be exposed to criticism, ridicule, and punishment from their teachers and others. Therefore, they may experience failure and frustration, which would in turn lead to poorer self-efficacy as compared to females. These conjectures are in line with Goleman's (2001) report that women are often perceived as more empathetic than men. Similarly, Bar-On (2004) reported that women assign more importance to emotions and they exhibit more empathy as compared to men.

Conclusions and implications

The main objective of this study was to identify the common thinking styles of both DHH and hearing students, and to examine if thinking styles predict self-efficacy. Our findings showed that Type II and III thinking styles were more prevalent among DHH students, while Type I thinking styles were more prevalent among hearing students. Further, Type I and II thinking styles were associated with higher and lower levels of self-efficacy, respectively. The findings also confirmed the presence of significant gender-based differences in the thinking styles and self-efficacy of DHH students. These results suggest the importance of Type I thinking styles in improving the self-efficacy of DHH students. Accordingly, it is recommended that teachers and professionals working with individuals with hearing impairments offer them opportunities to engage in more creative, less structured, and more cognitively complex tasks, which will in turn increase their use of Type I thinking styles (Torabi, 2013; Zhu & Zhang, 2011). Such tasks may also help students experience a sense of achievement, which will reflect positively on their self-efficacy (Cuevas et al., 2019). Several studies have also reported that this thinking style could be beneficial for excellence in personal or academic pursuits (e.g., Bulus, 2016; Fatemi & Heidarie, 2016; Xie et al., 2013) which are key determinants of self-efficacy in DHH students as well (Cuevas et al., 2019). Therefore, adolescent students in general, and those with hearing impairments in particular, are advised to proactively practice Type I thinking styles, such as dealing with unstructured tasks, seeking new information, and multi-tasking.

Strengths and limitations

This study has several strengths. It was the first to examine the relationship between thinking styles and self-efficacy among Saudi adolescent students. Further, it was the first to focus on the typical characteristics of DHH students. Finally, it was the first to translate and validate the TSI-R2 and SEQ-C scale among DHH and hearing adolescent students in Saudi Arabia. However, it also has several limitations. First, owing to the cross-sectional nature of the survey, the causal relationship between thinking styles and self-efficacy could not be established. Second, the sample was selected only from three cities in the southern region of the Kingdom of Saudi Arabia, which limits the generalizability of the results to other populations. Further, it is important to note that social constructs like self-efficacy differ based on several other factors such as hearing status, parents' hearing status, type of school attended, communication mode used at home and in school, and group identification, etc., to name

a few (Bat-Chava, 1993; Cuevas et al., 2019; Dammeyer et al., 2018). Indeed, the audiological and cultural definitions of the term "deaf" influence identity, group belongingness, and social perceptions. Additionally, acculturation, or the extent to which one is integrates the Deaf and hearing culture, has been found to influence the socio-emotional well-being of DHH adolescents (Lambez et al., 2020). Thus, the identity, self-efficacy, social skills, etc. of DHH individuals would differ based on school placement. The present sample only included DHH students from regular schools offering integration programs. As such, this population of DHH students would have more unique socio-cultural characteristics as compared to DHH students who may not be similarly acculturated. Furthermore, being in a deaf vs. hearing family influences social experiences and extent of exposure to the Deaf culture (Alqarni, 2017). However, Alqahtani (2017) acknowledges that there are not specific statistics on the number of DHH children in KSA, except for those attending schools. Therefore, it is unclear what percentage of the DHH children in KSA would have limited exposure to the Deaf culture. Additionally, the present study did not collect information on the variables that influence exposure to the Deaf culture, such as parents' hearing status, participation in Deaf clubs, access to services, communication mode, etc. As such, the present findings need to be interpreted keeping the socio-cultural characteristics of these integrated DHH students in mind. Furthermore, it is essential to acknowledge and examine the effect of the socialization process experienced by individuals with disabilities, the extensively prevalent ableism and disability prejudice, and their internalized oppression on their self-efficacy, especially in the case of DHH individuals living with hearing individuals. Despite these limitations, the present findings hold merit because they open avenues for future research. First, it is recommended that future studies employ a longitudinal or experimental design to advance our understanding of the impact of thinking styles on the self-efficacy of DHH students. Second, it is essential to employ a diverse sample in future replication studies to improve the generalizability of the findings. Third, a further examination of the effect of DHH students' thinking styles on various psychological, emotional, and academic factors would provide valuable information that could be used to develop effective interventions and training programs. Indeed, such programs could be used to improve the self-efficacy of students with disabilities in general and of those with hearing disabilities in particular.

Acknowledgements Financial support from Deanship of Scientific Research, Najran University, Saudi Arabia, NU/-/SEHRC/10/1064) is gratefully acknowledged.

Declarations

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study. The study was approved by Scientific Research Ethics Committee, Deanship of Scientific Research at Najran University (No. NU/-/SEHRC/10/1064).

Conflict of interest The authors declare that they have no conflict of interest.

References

Alamri, G. (2017). *Teachers' Beliefs and Attitudes about Saudi Arabia Sign Language*. Doctoral Dissertation, Beaumont, TX: Lamar University. https://search.proquest.com/openview/e6befad0e3239c71f953becd52f07984/1?pq-origsite=gscholar&cbl=18750&diss=y

Alofi, A. S., Clark, M. D., & Marchut, A. E. (2019). Life stories of Saudi deaf individuals. *Psychology*, *10*(11), 1506. https://doi.org/10.4236/psych.2019.1011099

Alqahtani, A. (2017). *Saudi Parents' Needs in Deaf Education in the Kingdom of Saudi Arabia*. University of Northern Colorado. https://www.proquest.com/openview/d569f704f6ec57dd9a6c4573f9afbda4/1?pq-origsite=gscholar&cbl=18750

Alqarni, F. (2017). *Hearing Parents of Deaf Children in Saudi Arabia: Communication Modes and Challenges*. Doctoral Dissertation, Beaumont, TX: Lamar University. https://search.proquest.com/openview/74230a219a657fce37d31269082adc14/1?pq-origsite=gscholar&cbl=18750&diss=y

Al-shammari, M., Ashankyty, A., Al-Mowina, N., Al-Mutairy, N., Al-shammari, L., & Amin, S. (2014). Social-emotional perceptions of deaf students in Hail, Saudi Arabia. *American Journal of Educational Research*, *2*(5), 304–315. https://doi.org/10.12691/education-2-5-11

Alzahrani, A. (2020). The Role of Fingerspelling in Saudi Arabian Deaf Culture. *International Journal of Disability Development and Education*, 1–17. https://doi.org/10.1080/1034912X.2020.1830951

Andretta, J. R., & McKay, M. T. (2020). Self-efficacy and well-being in adolescents: A comparative study using variable and person-centered analyses. *Children and Youth Services Review*, *118*, 105374.

Antia, S. D., Jones, P., Luckner, J., Kreimeyer, K. H., & Reed, S. (2011). Social outcomes of students who are deaf and hard of hearing in general education classrooms. *Exceptional children*, *77*(4), 489–504.

Bailey, T. K. M., Williams, W. S., & Favors, B. (2013). Internalized racial oppression in the African American community. In E. P. David (Ed.), *Internalized oppression: The psychology of marginalized groups* (pp. 137–162). Springer Publishing Company.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological review*, *84*(2), 191.

Bandura, A. (2006). Guide for constructing self-efficacy scales. *Self-efficacy beliefs of adolescents*, *5*(1), 307–337.

Bandura, A. (2013). Regulative function of perceived self-efficacy. *Personnel selection and classification* (pp. 279–290). Psychology Press.

Bar-On, R. (2004). The Bar-On Emotional Quotient Inventory (EQ-i): Rationale, description and summary of psychometric properties.
Bat-Chava, Y. (1993). Antecedents of self-esteem in deaf people: A meta-analytic review. *Rehabilitation Psychology*, *38*(4), 221.
Bearman, S., & Amrhein, M. (2013). Girls, women, and internalized sexism. In E. P. David (Ed.), *Internalized oppression: The psychology of marginalized groups* (pp. 191–226). Springer Publishing Company.
Bolívar-Cruz, A., Verano-Tacoronte, D., & Galván-Sánchez, I. (2018). Do self-efficacy, incentives and confidence in public speaking influence how students self-assess?/¿ Influyen la autoeficacia, los incentivos y la confianza para hablar en público en cómo se autoevalúan los estudiantes? *Cultura y Educacion*, *30*(3), 528–555.
Briggs, K. K., Lysholm, J., Tegner, Y., Rodkey, W. G., Kocher, M. S., & Steadman, J. R. (2009). The reliability, validity, and responsiveness of the Lysholm score and Tegner activity scale for anterior cruciate ligament injuries of the knee: 25 years later. *The American journal of sports medicine*, *37*(5), 890–897.
Buluş, M. (2016). Predictive analysis among thinking styles, goal orientations and academic achievement of student teachers. *Yükseköğretim Dergisi*, *6*(2), 62–71. http://acikerisim.pau.edu.tr:8080/xmlui/handle/11499/23036
Çelikkaleli, Ö. (2014). The relation between cognitive flexibility and academic, social and emotional self-efficacy beliefs among adolescents.Egitim ve Bilim, *39*(176).
Cheng, S. (2019). Conceptions of learning and thinking styles among deaf, hard-of-hearing, and hearing students. *Journal of Developmental and Physical Disabilities*, *31*(4), 555–573.
Cheng, S. (2021). The Change of Chinese University Students with Hearing Impairment in Thinking Styles: Implications for Inclusive/Mainstreaming Higher Education.International Journal of Disability, Development and Education,1–13.
Cheng, S., & Deng, M. (2020). Thinking Styles and Integration Among Deaf or Hard of Hearing and Hearing University Students. *American Annals of the Deaf*, *165*(1), 6–19.
Cheng, S., & Sin, K. F. (2021). Thinking Styles and Career Decision-making Self-efficacy among Deaf or Hard of Hearing, and Hearing Students. *Exceptionality*, *29*(3), 167–181.
Cheng, S., & Zhang, L. (2014). Validating the Thinking Styles Inventory–Revised II among Chinese university students with hearing impairment through test accommodations. *American Annals of the Deaf*, *159*(1), 22–33.
Cheng, S., & Zhang, L. (2015). Thinking style changes among deaf, hard-of-hearing, and hearing students. *The Journal of Deaf Studies and Deaf Education*, *20*(1), 16–26.
Cheng, S., & Zhang, L. (2017). Thinking styles and quality of university life among deaf or hard of hearing and hearing students. *American Annals of the Deaf*, *162*(1), 8–23.
Cheng, S., Hu, X., & Sin, K. F. (2016). Thinking styles of university deaf or hard of hearing students and hearing students. *Research in Developmental Disabilities*, *55*, 377–387.
Cheng, S., Wang, T., & Sin, K. (2021). Thinking Styles and Student Engagement among Deaf and Hard of Hearing Students. *Journal of Developmental and Physical Disabilities*, *33*, 217–232.
Cheng, S., Zhang, L. F., & Hu, X. (2016). Thinking styles and university self-efficacy among deaf, hard-of-hearing, and hearing students. *Journal of Deaf Studies and Deaf Education*, *21*(1), 44–53.
Cohen, J. (1992). Statistical power analysis. *Current directions in psychological science*, *1*(3), 98–101.
Crowe, T. V. (2021). Factors associated with help-seeking and self-efficacy among a sample of deaf adults. *Journal of Developmental and Physical Disabilities*, *33*(1), 51–63.
Crowe, T. V. (2021). Factors associated with help-seeking and self-efficacy among a sample of deaf adults. *Journal of Developmental and Physical Disabilities*, *33*(1), 51–63. https://doi.org/10.1007/s10882-020-09739-9
Cuevas, S., Chen, R. K., Vang, C., & Saladin, S. P. (2019). Determinants of self-efficacy among individuals who are hard-of-hearing.
Dammeyer, J., Marschark, M., & Zettler, I. (2018). Personality traits, self-efficacy, and cochlear implant use among deaf young adults. *Journal of Deaf Studies and Deaf Education*, *23*(4), 351–359. https://doi.org/10.1093/deafed/eny022
David, E. P. (2013). *Internalized oppression: The psychology of marginalized groups*. Springer Publishing Company.
Diseth, Å. (2011). Self-efficacy, goal orientations and learning strategies as mediators between preceding and subsequent academic achievement. *Learning and Individual Differences*, *21*(2), 191–195.
Evans, S. (2021). Case Study: Short and Long-Tenn Comparison of Two Siblings with Cochlear Implants-One Implanted at 13.
Fan, J. (2016). The role of thinking styles in career decision-making self-efficacy among university students. *Thinking Skills and Creativity*, *20*, 63–73.
Farber, G. (2015). Social perception toward Deafness: How could it influence Deaf identity development and the Deaf community. *Gallaudet Chronicles of Psychology*, *3*(1), 10–13.
Fatemi, M., & Heidarie, A. (2016). Relationship between thinking styles and academic achievement of the students. *International Journal of Humanities and Cultural Studies (IJHCS) ISSN 2356–5926, 2*(4), 1353–1361.
Gibbons, M. M., Justina, H., Cihak, D. F., Wright, R., & Mynatt, B. (2015). A social-cognitive exploration of the career and college understanding of young adults with intellectual disabilities. *Professional School Counseling*, *19*(1), 1096–2409.
Goleman, D. (2001). Emotional intelligence: Issues in paradigm building. *The emotionally intelligent workplace*, *13*, 26.
Goleman, D., Bennett, L., & Barlow, Z. (2012). *Ecoliterate: How educators are cultivating emotional, social, and ecological intelligence*. John Wiley & Sons.
Goodley, D. (2014). *Dis/ability studies: Theorising disablism and ableism*. Taylor & Francis Group.
Greco, G. (2021). Multilateral teaching in physical education improves resilience and self-efficacy in adolescents and could help reduce bullying behaviors. *Physical Culture and Sport*, *90*(1), 1–9.
Grigorenko, E. L., & Sternberg, R. J. (1995). Thinking styles. *International handbook of personality and intelligence* (pp. 205–229). Springer.
Habibi, M., Tahmasian, K., & Ferrer-Wreder, L. (2014). Self-efficacy in Persian adolescents: Psychometric properties of a Persian version of the Self-Efficacy Questionnaire for Children (SEQ-C). *International Perspectives in Psychology*, *3*(2), 93–105.
Hamdan, A. (2005). Women and education in Saudi Arabia: Challenges and achievements. *International Education Journal*, *6*(1), 42–64.
Hamid, A., Saputro, S., & Masykuri, M. (2021). Analysis of critical-creative thinking styles and their implications on self efficacy teacher pree service. Journal of Physics: Conference Series.
Higgins, M., & Lieberman, A. M. (2016). Deaf students as a linguistic and cultural minority: Shifting perspectives and implications for teaching and learning. *Journal of Education*, *196*(1), 9–18.
Hintermair, M. (2008). Self-esteem and satisfaction with life of deaf and hard-of-hearing people—A resource-oriented approach to identity work. *Journal of Deaf Studies and Deaf Education*, *13*(2), 278–300.
Hipolito-Delgado, C. P., Payan, G., S., & Baca, T. I. (2013). Self-hatred, self-doubt and assimilation in Latina/o communities. In E. P. David (Ed.), *Internalized oppression: The psychology of marginalized groups* (pp. 109–136). Springer Publishing Company.
Hodge, N., & Runswick-Cole, K. (2013). 'They never pass me the ball': exposing ableism through the leisure experiences of disabled children, young people and their families. *Children's Geographies*, *11*(3), 311–325.

Holcomb, T. K. (2013). *Introduction to American Deaf Culture*. New York: Oxford University Press.
Jóhannsdóttir, Á., Egilson, S., & Haraldsdóttir, F. (2022). Implications of internalised ableism for the health and wellbeing of disabled young people. *Sociology of Health & Illness*, *44*, 360–376. DOI: https://doi.org/10.1111/1467-9566.13425
Kelly-Campbell, R. J., & McMillan, A. (2015). The relationship between hearing aid self-efficacy and hearing aid satisfaction. *American journal of audiology*, *24*(4), 529–535.
Ladd, P., & Lane, H. (2013). Deaf ethnicity, deafhood, and their relationship. *Sign Language Studies*, *13*(4), 565–579.
Lambez, T., Nagar, M., Shoshani, A., & Nakash, O. (2020). The association between deaf identity and emotional distress among adolescents. *The Journal of Deaf Studies and Deaf Education*, *25*(3), 251–260. https://doi.org/10.1093/deafed/enz051
Leigh, I. (2009). *A lens on deaf identities: Perspectives on deafness*. Oxford University Press.
Leigh, I. W., Andrews, J. F., & Harris, R. L. (2018). *Deaf Culture: Exploring Deaf Communities in the United States*. San Diego, CA: Plural Publishing.
Liebow, N. (2016). Internalized oppression and its varied moral harms: Self-perceptions of reduced agency and criminality. *Hypatia*, *31*(4), 713–729.
Lotz, M. J. (2021). The threat of ableist attitudes on the performance and well-being of individuals with disabilities [Doctoral dissertation, Purdue University Graduate School]. https://doi.org/10.25394/PGS.17145767.v1
McRuer, R. (2006). *Crip Theory Cultural Signs of Queerness and Disability*. New York University Press.
Meyer, C., Hickson, L., & Fletcher, A. (2014). Identifying the barriers and facilitators to optimal hearing aid self-efficacy. *International journal of audiology*, *53*(sup1), S28–S37.
Minter, A., & Pritzker, S. (2017). Measuring adolescent social and academic self-efficacy: cross-ethnic validity of the SEQ-C. *Research on Social Work Practice*, *27*(7), 818–826.
Muris, P. (2001). A brief questionnaire for measuring self-efficacy in youths. *Journal of Psychopathology and behavioral Assessment*, *23*(3), 145–149.
Muris, P. (2002). Relationships between self-efficacy and symptoms of anxiety disorders and depression in a normal adolescent sample. *Personality and individual differences*, *32*(2), 337–348.
Nadal, K. L., King, R., Sissoko, D. G., Floyd, N., & Hines, D. (2021). The legacies of systemic and internalized oppression: Experiences of microaggressions, imposter phenomenon, and stereotype threat on historically marginalized groups. *New Ideas in Psychology*, *63*, 100895. https://doi.org/10.1016/j.newideapsych.2021.100895
Phan, H. P. (2007). An examination of reflective thinking, learning approaches, and self-efficacy beliefs at the University of the South Pacific: A path analysis approach. *Educational Psychology*, *27*(6), 789–806.
Sagone, E., & De Caroli, M. E. (2013). Relationships between resilience, self-efficacy, and thinking styles in Italian middle adolescents. *Procedia-Social and Behavioral Sciences*, *92*, 838–845.
Sarvghad, S., Rezaee, A., & Masomi, F. (2011). *On the Relationship between Thinking Styles*. and Self-Efficacy of Pre-University Students in Shiraz.
Saudi Deaf Sports Federation (2017). Saudi Committee for Sign Language Experts and Interpreters. http://www.sdsf.gov.sa/
Sternberg, R. (1992). Sternberg-Wagner Thinking Styles Inventory: project summary. *Pridobljeno*, *11*, 2004.
Sternberg, R. J. (1988). Mental self-government: A theory of intellectual styles and their development. *Human development*, *31*(4), 197–224.
Sternberg, R. J. (1990). Thinking styles: Keys to understanding student performance. *The Phi Delta Kappan*, *71*(5), 366–371.
Sternberg, R. J. (1994). Allowing for Thinking Styles. *Educational leadership*, *52*(3), 36–40.
Sternberg, R. J., Grigorenko, E. L., & Zhang, L. (2008). Styles of learning and thinking matter in instruction and assessment. *Perspectives on Psychological Science*, *3*(6), 486–506.
Sternberg, R. J., Wagner, R., & Zhang, L. F. (2007). Thinking styles inventory: revised II (TSI-R2). *Tufts University.*
Sternberg, R. J., Zhang, L. F., & Rayner, S. (2011). Handbook of intellectual styles: Preferences in cognition, learning, and thinking.
Sternberg, R., Wagner, R., & Zhang, L. (2003). *Thinking styles inventory-revised*. Unpublished test, Yale University.
Tan, S. K., & Chellappan, K. (2018). Assessing the validity and reliability of the Self-Efficacy Questionnaire for Children (SEQ–C) among Malaysian adolescents: Rasch model analysis. *Measurement and Evaluation in Counseling and Development*, *51*(3), 179–192.
Torabi, F. (2013). The role of thinking styles in predicting dimensions of creativity among talented and high-achiever university students. *International Journal of Behavioral Sciences*, *6*(4), 369–376.
Walters, G. D., & Lowenkamp, C. T. (2016). Predicting recidivism with the Psychological Inventory of Criminal Thinking Styles (PICTS) in community-supervised male and female federal offenders. *Psychological assessment*, *28*(6), 652.
Watermeyer, B., & Gorgens, T. (2013). Disability and internalized oppression. In E. P. David (Ed.), *Internalized oppression: The psychology of marginalized groups* (pp. 253–280). Springer Publishing Company.
Watermeyer, B., & Swartz, L. (2008). Conceptualising the psychoemotional aspects of disability and impairment: The distortion of personal and psychic boundaries. *Disability & Society*, *23*, 599–610.
Xie, Q., Gao, X., & King, R. B. (2013). Thinking styles in implicit and explicit learning. *Learning and Individual Differences*, *23*, 267–271. https://doi.org/10.1016/j.lindif.2012.10.014
Zhang, L. F. (2008). Thinking styles and emotions. *The Journal of psychology*, *142*(5), 497–516.
Zhang, L. (2009). Anxiety and thinking styles. *Personality and individual differences*, *47*(4), 347–351.
Zhang, L. F., & Sternberg, R. J. (2000). Are learning approaches and thinking styles related? A study in two Chinese populations. *The Journal of psychology*, *134*(5), 469–489.
Zhang, L., & Sternberg, R. J. (2005). A threefold model of intellectual styles. *Educational psychology review*, *17*(1), 1–53.
Zhang, L., & Sternberg, R. J. (2012). *The nature of intellectual styles*. Routledge.
Zhang, L. F., & Sternberg, R. J. (2014). Thinking styles across cultures: Their relationships with student learning. *Perspectives on thinking, learning, and cognitive styles* (pp. 197–226). Routledge.
Zhang, L., Sternberg, R. J., & Rayner, S. (2012). *Intellectual styles: Challenges, milestones, and agenda*. Springer Publishing Co.
Zhu, C., & Zhang, L. F. (2011). Thinking styles and conceptions of creativity among university students. *Educational Psychology*, *31*(3), 361–375. https://doi.org/10.1080/01443410.2011.557044