

## **Q Methodology: A promising method to investigate mindsets**

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### **Abstract**

Mindsets which are beliefs and fundamental perceptions about our life as well as how we cope with challenges in life play a pivotal role in our learning and development. These subjective views determine our mental attitudes and behavior. Mindsets, therefore, have attracted considerable attention from scholars in different fields. In education, mindsets have been investigated using different research instruments ranging from questionnaires, interviews, and other self-report methods. However, the subjective and complex nature of individuals' mindsets are major challenges in mindset research. In this paper, we proposed the use of Q instruments as a promising tool for dealing with these challenges. Q procedures consist of a methodical design of Q statements, Q grid, in-depth interviews with participants, and the Q inverted factor analysis technique. This paper illustrates how the method can be employed to effectively to reveal participants' mindsets. Principles, detailed procedures, and applications to research in teacher education are also discussed.

### **1. What are mindsets?**

#### ***1.1 The conceptual development of mindsets***

Mindset studies were inspired by Carol Dweck's early work on why people remain persistent when encountering failure. She observed that people reacted differently when facing problems. The term 'mindset' (originally known as implicit theories of intelligence) has been identified as the beliefs of humans' intelligence, morality, and personality (Dweck & Leggett, 1988). It is believed to be the factor that drives people's decision to cope or not to cope with failure as well as their attitudes towards life.

Mindsets have been classified as fixed mindset and growth mindset (previously identified as entity and incremental theories respectively). A fixed mindset is identified as beliefs that intelligence cannot be changed, while growth mindset as belief that intelligence can be improved (Bandura & Dweck, 1985; Blackwell et al., 2007).

The concept of mindsets influences deeply the directions that people live their lives (Dweck, 2006). As a matter of fact, it is related directly to humans' daily life activities e.g. interpersonal relationship (Lou & Li, 2017), intergroup relations (Rattan & Georgeac, 2017), well-being (Lee et al., 2018), and learning processes, not only in classrooms but also life-long learning (Dweck, Walton, & Cohen, 2014).

### ***1.2 The dichotomous characteristics of mindsets***

Mindsets influence learners' academic achievement (Burnette et al., 2013; Dweck, 2000; Haimovitz & Dweck, 2017; Tirri & Kujala, 2016; Yeager & Walton, 2011). Learners with fixed and growth mindsets behave differently based on the mindsets they possess. Dweck (2009) describes how, in being influenced by their own belief that intelligence is static so it cannot be changed, fixed mindset learners tend to focus on what they believe they have as a talent and do their best to look smart. As a result, they tend to protect the belief by avoiding challenges, other people's useful negative feedback, and successful stories of others. On the contrary, learners with growth mindset believe that intelligence and ability can be developed with effort and strategies, so they desire to learn, welcome challenges, use effort as a way towards mastery, learn from others' useful negative feedback, as well as successful stories as good examples and inspiration.

Furthermore, a significant amount of mindset studies have focused on learners (e.g. Gutshall, 2013; Pretzlik et al., 2003) showing that learners with fixed mindset tended to decrease in academic achievement (Dweck, 2007) and those with growth mindset gained academic achievement (e.g. Blackwell et al., 2007; Claro et al., 2016; Dweck & Leggett, 1988), while the mindset interventions were reported useful to learners' academic achievement (Schmidt et al., 2015; Schmidt et al., 2016) especially for those with unsuccessful learning experience before (Paunesku et al., 2015). However, mindset interventions also reported that positive effects on learners' academic achievement were temporary (Orosz et al., 2017). This adds an area of investigation for further studies about what factors within mindset interventions might provide longer positive effects on learners' academic achievement.

### ***1.3 Language mindsets***

The concept of Dweck's mindsets (2006) has been adopted for studying language learners' mindsets by Mercer and Ryan (see Mercer & Ryan, 2009). Moreover, Lou and Noels have made a significant contribution to language mindset studies more systematically by connecting language mindsets with other motivational factors such as failure and goal orientation (Lou & Noels, 2016), creating a self-report language mindset survey questionnaire in order to understand language learners' mindsets (Lou & Noels, 2017) and proposing the framework of language mindset definitions (Lou & Noels, 2019a).

Lou and Noel (2019b) defined language mindsets with empirical evidence from previous mindset studies (see Bai et al., 2019; Blackwell et al., 2007; Grant & Dweck, 2003; Haimovitz & Dweck, 2016; Hong et al., 1999; Lou & Noels, 2016, 2017, 2019b; Papi et al., 2019; Robins & Pals, 2002) as beliefs or attitudes about malleability for language learning. Moreover, a language learners' emotional experience could influence motivation in learning a target language. As a result, language learners with fixed or growth mindsets tend to have different learning characteristics. Language learners with fixed mindset believe that the ability to learn a target language is from natural talent, causing them to focus on the talents that they believe they possess by outperforming others, doing downward comparisons, protecting themselves by avoiding challenges, inability, failures, and effort. Because of this, fixed mindset language learners could have anxiety when they use a target language. Language learners with growth mindset, conversely, believe that the ability to learn a target language can be developed with hard work. When they learn, they focus on learning with the use of effort, strategies, motivation, and feedback from others, and even failure: making them confident and enjoy challenges when using a target language.

Recently, the amount of language mindset studies within only the last two years (2020 – 2021) have increased dramatically as compared with the previous ten years ago (2009 – 2019). Among these recent studies, the side of language learners' mindsets was mainly focused (see Eren & Rakıcioğlu-Söylemez, 2020; Lou & Noels, 2020a; Lou & Noels, 2020b; Ozdemir & Papi, 2021; Sadeghi et al., 2020; Sato, 2021; Shirvan et al., 2021; Wang et al., 2021; Yao et al., 2021; Zarrinabadi et al., 2021).

## 2. Mindset research instruments

### 2.1 *The implicit theories of intelligence scales*

In 2000, Professor Carol Dweck created the Implicit Theories of Intelligence Scale for Children (10 years old and above) and Implicit Theories of Intelligence Scale for Adults as self-report mindset survey questionnaires for researchers to investigate mindsets about intelligence. Many researchers have adopted or adapted them to study the mindsets of their participants. As a result, there have been many versions of mindset instruments ranging from three to eight questions to be selected for implementation in mindset studies. For example, the versions with only fixed mindset questions or growth mindset questions (e.g., Mahmud & Gagnon, 2020; Zeng et al., 2016), the one covering all mindset questions (e.g., De Kraker-Pauw et al., 2017; Waller & Papi, 2017), and those translated versions into several languages such as Mandarin and Dutch (Glerum et al., 2018; Zhao et al., 2018). For mindset data analysis, the data collected from the questionnaires were analyzed with the score-reversed technique: low or high scores representing either fixed or growth mindsets (e.g. De Kraker-Pauw et al., 2017) based on the questions in the questionnaires; whether they are the fixed mindset questions, the growth mindset questions, or both. These self-report mindset survey questions were reported with high internal consistency (Cronbach's alpha value) confirming high validity and reliability (Kraker-Pauw et al., 2017; Midkiff et al., 2018).

### 2.2 *The most widely used mindset instruments*

Based on Google Scholar searches of mindset research between 2010 – 2020, 86 relevant studies were found (e.g., Aditomo, 2015; Corradi et al., 2018; Gutshall, 2016; Lee et al., 2010; Ngek, 2012; O'Rourke et al., 2014; Posey et al., 2011; Septianto, 2020; Stewart et al., 2017; Wyles et al., 2013; Zhang et al., 2019). Of these studies, 90% used mindset questionnaires as a research instrument, 6% implemented interviewing, 3% used a mixed method of a questionnaire and interview, and 1% tried activities as Table 1 shows below.

**Table 1.** Types of mindset research instruments between 2010 - 2020

Instruments used	Total amount of used mindset research instruments	
	Number of research studies	Percentages
Questionnaires	77	90%
Interviews	5	6%
Mixed Method	3	3%
Activities	1	1%

It can be concluded that the most widely used mindset research instrument in the last decade was a self-report mindset survey questionnaire. Nonetheless, questionnaires tend to have limitation on categorizing mindsets of participants (Lou & Noels, 2019a).

### ***2.3 New perspectives on dichotomous mindsets and mindset research instrument challenges***

Due to the characteristics of self-report mindset survey questionnaires which most researchers have been using as instruments to investigate mindsets for decades, there are limitation in understanding mindsets of participants: the tendency that they are constructed from researchers' interests and understandings (Irie et al., 2018) and provide solely dichotomous views of mindsets without a distinct point between the two mindsets (Lou & Noels, 2019a).

Moreover, mindsets are complicated in nature. Individuals do not have only one mindset, but rather possess separate mindsets in various domains (Irie et al., 2018). Arguably, language mindsets might be even more complex since language learners are normally related to mixed mindsets and they could have different mindsets in sub-domains, such as the ability to learn speaking and reading skills (Mercer & Ryan, 2009). Lou and Noels (2019a) exemplified that one language learner could have a growth mindset in the ability to learn grammar while this same learner could have a fixed mindset differently in the ability to improve pronunciation.

As a result, it has been proposed that potential mindset research instruments should not only be able to elicit mindset data from participants more deeply, but also be adaptable accordingly to different specific purposes of researchers' mindset studies. Possible instruments include implementing mixed methods, network analysis approach, longitude studies, ethnography, network analysis, circumplex models, latent profile/transition approaches, retrodictive qualitative modelling (Lou & Noels, 2019a), daily diary methods, idiodynamic approach (Dornyei et al., 2015), neuroscience methods (see Ng, 2018), and Q methodology (Haukås & Mercer, 2021; Irie et al., 2018).

## **3. Q methodology**

### ***3.1 Benefits of Q methodology***

Q methodology is a mixed quantitative and qualitative research instrument created by William Stephenson in 1930s (McKeown & Thomas 1988) but is still new in applied linguistics (e.g. self-efficacy and learners' perceptions of teaching tools, see Bodnar, 2016; Irie, 2014; Rodriguez & Shepard, 2013). The benefits of Q methodology can be gained from the unique characteristics of Q data collection and analysis, which consist of Q statements, Q Grid, in-depth interview, and Q inverted factor analysis techniques – originally used in the field of psychology (Watts & Stenner, 2012).

As Q statements and Q Grid treat all participants as variables of a research instrument during data collection, in contrast to a self-report survey questionnaire in which the scales on a questionnaire are set as variables (Watts & Stenner, 2005). Q data analysis done with PQMethod Software (QMethod Page. 2014) can link participants' viewpoints into a statistical network known as Q correlations and factor the data – not from questionnaire items (Shemmings, 2006).

With the outcome of such Q correlation data, if Q methodology is used for investigating mindsets, the analyzed data will be valuable for a deeper interpretation and discussion of mindsets because the relationships between similar viewpoints from all participants will be shown without a dichotomy perspective. In other words, all of the viewpoints that the participants rate during the Q grid interviews would be taken into consideration. The mostly agreed, neutrally agreed and least agreed items would all be valued making Q methodology a promising tool for investigating people's complicated mindsets (Irie et al., 2018).

### 3.2 The three steps to implement Q methodology

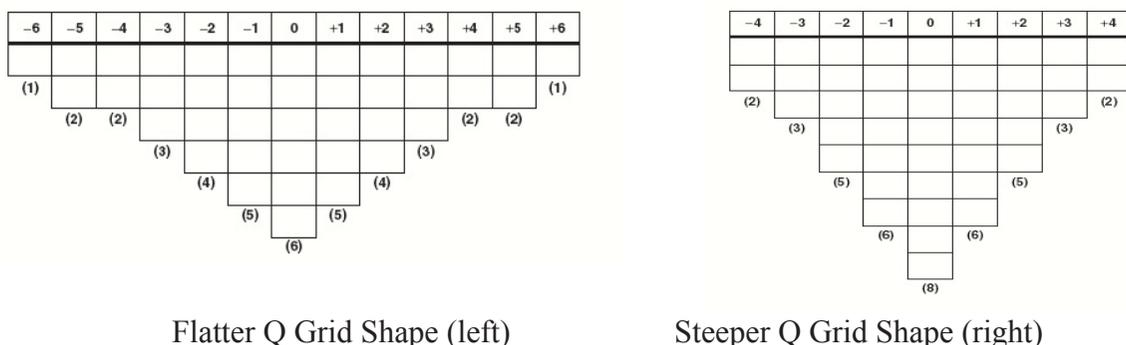
#### 3.2.1 Q instrument preparation: Q statements, Q grid, and interview questions

Before preparing Q instrument, researchers must identify the topic of studies and the total number of participants (also referred as P-set). The total number of Q participants should be under a minimum ratio of two Q statements to each single participant, meaning the minimum number of participants should be half than the total number of Q statements (Watts & Stenner, 2012): while the minimum number of participants is 12 (Webler, Danielson, & Tuler: 2009, p. 21), and the maximum number is typically 40 (Brown, 2003). The data collected with Q methodology has reliability and can be generalizable to a larger population even though data is collected from a small number of participants. The Q data interpretation for generalizability is based on semantic interpretation, not from statistics (Thomas & Baas, 1992/1993: 22), to examine existing false generalizations established with R methodology, which is a normal factor analysis (Stephenson, 1935). R methodology involves findings correlations between variables across a sample of subjects while Q methodology explorer correlations between subjects across a sample of variables. The following steps include how to do Q semantics interpretation: a) participants' viewpoints are analyzed with conceptual analysis (Watts & Stenner, 2012), b) the Q conceptual data relating to those studies' false generalizations are investigated, and c) the issues to correct or give better understandings of those R data's false generalizations such as weak professional practice or preconception are identified. With this Q semantics generalizability, Q methodology can provide the implications of generalizations much more deeply than R methodology (Watts & Stenner, 2012).

Q statements are statements representing participants' opinions or arguments about researchers' topic under study (Exel & Graaf, 2005). They need to correspond to research question(s) so that participants can express their viewpoints of agreement, disagreement, and neutrality. Q statements could not only be in the strict form of statements but also in other forms such as descriptions of behaviors, objects, traits (Stephenson, 1952) and even photos (Watts & Stenner, 2012). The potential sources for creating Q statements are literature review, samples, and any other potential media (Watts, 2001). The standard number of Q statements is 40 – 80 items (Curt, 1994; Stainton Rogers, 1995; Watts & Stenner, 2012).

Q grid is a forced-choice distribution shaped instrument in which a specific number of items already assigned to each ranking value (Watts & Stenner, 2012) for participants to place all Q statements on to express their points of views about the topic of study. The shape of Q grid could be varied in the form of a quasi-normal distribution: running on a continuum from 'agree more' to 'agree less' while the middle area represents the views of neutrality. The shapes of Q grid could be varied in the degrees of flatness and steepness. Figure 1 shows two different examples: the flatter shape (left) and the steeper shape (right) (Watts & Stenner, 2012).

**Figure 1.** Flatter & Steeper Shapes of Q Grid



Questions for interviews provide a) more understanding of participants on the topics of studies, b) reasons behind participants' finished Q sorting and any significance of important and outstanding items, and c) in-depth data for interpretation (Watts & Stenner; 2012).

Once Q instrument preparation is done, experts in the field of study should be invited to join in the process of checking, reviewing, piloting, and revising Q instruments accordingly.

### 3.2.2 Q data collection

The communicative channels for collecting Q data are flexible and varied. They could be face-to-face communication or even online Zoom especially during the COVID-19 pandemic. Collect Q data includes both Q sorting and in-depth interview. For participants to do Q sorting, researchers can help by guiding them to divide all Q statements into three temporary ranking groups of agreement, disagreement, and neutrality onto the Q grid (Watts & Stenner, 2012). However, in case participants feel more comfortable to do Q-sorting on their own (e.g., starting the arrangement with the statements they disagree with or are neutral about), this is possible, too. Moreover, one of the most important things is that participants should be asked to mark areas of agreement, disagreement, and neutrality on the Q-grid because such the data will be beneficial for researchers during factor interpretation afterwards. Figure 2 shows an example of Q sorting with areas marked for agreement, disagreement, and neutrality.

**Figure 2.** Example of Q sorting marked into three viewpoint groups

-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
47	29	36	38	12	30	10	40	39	01	17
23	33	35	43	18	32	46	02	19	04	28
(2)	24	27	11	34	44	03	26	25	08	(2)
	(3)	20	22	09	05	31	41	45	(3)	
		(4)	15	06	37	16	42	(4)		
			(5)	48	13	21	(5)			
				(6)	07	(6)				
					14					
					(8)					

Exemplified Q sorting with marked areas of agreement, disagreement, neutrality

The Q data collection including Q sorting and in-depth interview can consume time differently. My own recent direct experience in collecting Q data with 40 Q statements and in-depth interview with 20 participants, took approximately two hours and a half with each participant.

### 3.2.3 Q Data analysis & interpretation

The main function of Q methodology is to find factors and the pattern of the factor loadings (Stevens, 1996) using a people-based factoring approach (Cattell, 1966) to analyze data and finally show the correlations among all participants' viewpoints (Shemmings, 2006) particularly those with similar viewpoints from the Q sorting (Bradley, 2007). To analyze and interpret Q data, a free downloadable and statistical program called PQMethod Software which has been developed, revised, and maintained by Peter Schmolck for use by studies implementing Q methodology (PQMethod Page, 2014). Using PQMethod Software starts from inputting

data of Q grid, Q statements, and Q sorting from participants into the program; then analyzing Q data with the help from several functions of the program; and finally interpreting Q data with both the results from Q data analyzed with the program and the data from in-depth interviews.

A few of the steps to use PQMethod Software for analyzing Q data includes un-rotated factoring, rotated factoring, and selecting final factors for interpretation. The function of the program called “Centroid Factor Analysis” (Brown & Stephenson, 1980) does the un-rotated factoring task and shows a primary link for each Q sort within each factor (Watts & Stenner, 2012). The “Q Varimax” function does the rotated Varimax, showing loadings of each Q sort (see Watts & Stenner, 2012). Then, researchers select final the factors for interpretation based on several values of factor loading of the variance (Child, 1970), Eigen Values (Watts & Stenner, 2012), and a high or low number of loaders (Jaffares, 2010). After the final factors have been accordingly selected and named, researchers can interpret and discuss the Q data based on their research question(s) for the study. The manual for how to use PQMethod Software is available at website <http://schmolck.org/qmethod/pqmanual.htm> (PQManual. 2014). Figure 3 shows the PQMethod Main Page where researchers can start data analysis and interpretation.

**Figure 3.** Main page of PQMethod software

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PQMethod - 2.35
(Mar 2014)

by Peter Schmolck
Adapted from Mainframe-Program QMethod
by John Atkinson at KSU

The QMethod Page:
http://schmolck.org/qmethod/

Enter IPath andl Project Name:
data
Current Project is ... C:\PQMethod\projects\data
Choose the number of the routine you want to run and enter it.

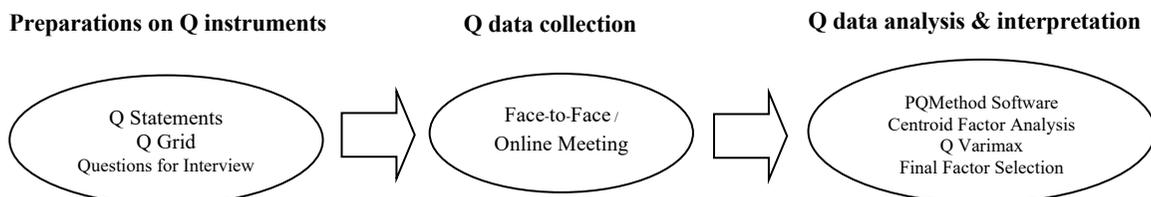
1 - STATES - Enter (or edit) the file of statements
2 - QENTER - Enter q sorts (new or continued)
3 - QCENI - Perform a Centroid factor analysis
4 - QPCA - Perform a Principal Components factor analysis
5 - QROTATE - Perform a manual rotation of the factors
6 - QVARIMAX - Perform a varimax rotation of the factors
7 - QANALYZE - Perform the final Q analysis of the rotated factors
8 - QVIEWLIST - View output file data.lis
X - Exit from PQMethod

Last Routine Run Successfully - <Initial>
    
```

PQMethod software main page

In conclusion, the three Q methodological steps of instrument preparation, data collection, and data analysis & interpretation are recommended for language mindset studies. Figure 4 shows the suggested procedures to implement Q methodology.

**Figure 4.** Suggested procedures on Q methodology implementation



### 3.3 Sample applications of Q methodology in language teaching and learning mindset studies

In language teaching and learning studies, Q methodology has also been adopted. For instance, it has been implemented in the studies about pre-service language teachers' mindsets (Irie et. al., 2018; Haukås & Mercer, 2021). Table 2 shows the details of the two studies using Q methodology as a promising tool for investigating mindsets.

**Table 2.** Two language teaching and learning mindset studies with Q method

<b>Details of the studies</b>	<b>Study 1:</b> Using Q methodology to investigate pre-service EFL teachers' mindsets about teaching competences (Irie et. al., 2018)	<b>Study 2:</b> Exploring pre-service language teachers' mindsets using a sorting activity (Haukås & Mercer, 2021)
1. Research questions	Mindsets of pre-service EFL teachers about teaching competences.	Mindsets of pre-service language teachers about teaching competences.
2. Participants	51 pre-service EFL teachers at an Austrian university.	12 pre-service language teachers in Austria and Norway.
3. Q methodology	56 Q statements, Q grid, no interview	Adapted Q method with 13-statements sorting activities on a continuum scale from 1 (not changeable) to 6 (changeable), two semi-structured interviews (pre- and post- sorting), background questionnaire
4. PQMethod Software	Centroid Factor Analysis (Brown, 1980), Q Varimax (Watts & Stenner, 2012), final factor selection	Intelligent verbatim transcription. NVivo and Atlas (qualitative analysis tool) for coding themes, not using PQMethod
5. Mindset data	Q sorts extracted in 3 major factors with similar mindset viewpoints. Top and bottom Q statements of each factors shown.	Data were transcribed and themed into mindset orientations and mindset systems of beliefs.

Study 1 Using Q methodology to investigate pre-service EFL teachers' mindsets about teaching competences (Irie et. al., 2018) used Q instruments including a) 56 Q statements with the descriptions about teaching competences, b) Q grid, and c) Q sorting activities to collect mindset data from 51 participants.

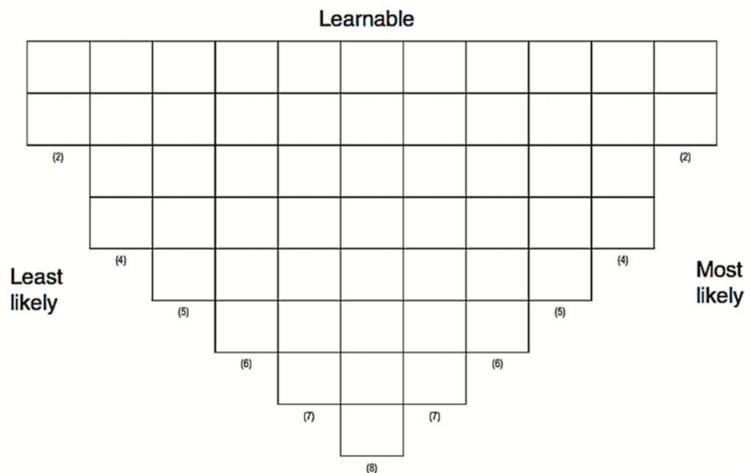
Firstly, several sources of academic literature, narratives, and newspaper articles were compiled to create the final set of 56 Q statements verified by five experts in applied linguistics. All these 56 Q statements were descriptive statements about characteristics of good language teachers. Table 3 shows the 56 Q statements of Study 1.

**Table 3.** The 56 Q statements about characteristics of good language teachers used in Study 1

No	Statements	No	Statements	No	Statements
1	Being enthusiastic about teaching.	20	Reflecting on one's own teaching.	39	Being highly proficient in the target language.
2	Acting as a mentor to learners.	21	Using the target language throughout the lesson.	40	Treating all learners equally.
3	Being confident in a classroom.	22	Focusing on practising speaking skills.	41	Finding the right balance between being strict and friendly.
4	Being warm-hearted with learners.	23	Giving constructive feedback.	42	Developing materials to supplement the textbook.
5	Creating useful handouts for one's learners.	24	Encouraging learners to speak without worrying about mistakes.	43	Providing an insight into the target language culture.
6	Having a good sense of humour in class.	25	Smiling in the classroom.	44	Being approachable for learners.
7	Creating good student-teacher-relationships.	26	Having good classroom management skills.	45	Taking learners' concerns seriously.
8	Having clear objectives for each lesson.	27	Promoting critical thinking skills in one's learners.	46	Being able to focus on meaning rather than grammatical form.
9	Assigning effective homework.	28	Praising learners appropriately.	47	Expressing clearly what one expects from one's learners.
10	Serving as an inspiration for one's learners.	29	Staying in control of one's emotions in the classroom.	48	Being able to control one's classes.
11	Explaining language in more than one way.	30	Being well organized in one's professional work.	49	Having a passion for teaching.
12	Engaging actively with the professional literature.	31	Understanding individual learners' needs.	50	Creating an entertaining atmosphere to carry out class activities.
13	Having a deep love of the language.	32	Loving one's job.	51	Being on time for classes.
14	Helping one's learners to love the subject.	33	Caring about one's learners.	52	Designing entertaining classroom activities.
15	Being flexible in one's teaching.	34	Being aware of different learning styles.	53	Being imaginative in one's teaching.
16	Remembering the names of learners.	35	Being kind to learners.	54	Motivating one's learners.
17	Providing challenge for one's learners.	36	Having good pronunciation.	55	Encouraging one's learners to use their skills beyond the classroom.
18	Being patient with learners.	37	Having an understanding of the details of language and grammar.	56	Persevering with weaker learners.
19	Monitoring learners' progress effectively.	38	Serving as positive role models.		

Next, these 56 Q statements were transformed into the form of 56 cards identified with a number so that the 51 participants could use these cards to express their beliefs about how learnable each of these 56 teaching aspects was – based on the purpose of Study 1. To express their beliefs, participants did the activity called Q sort in which each of the 51 participant ranked all 56 Q numbered cards on Q Grid – the forcing pattern of 56 small squares showing the meaningful areas from “Most likely” on the rightmost side to “Least likely” on the leftmost side, while the top center identified the descriptive word “Learnable”. Each position on Q Grid had its own value or numerical form for analyzing participant data, although these values were hidden to the participants. Fig. 5 (Irie et. al., 2018) shows Q Grid of Study 1 that was used for collecting data on the 51 participants’ mindsets.

**Figure 5.** Q grid used for Q sorting activities in Study 1 (Irie et. al., 2018)



Q grid for 51 participants to do Q sort in Study 1

After Q sorting activities, all 51 participants’ mindset data about teaching competences shown on the Q grid were recorded one by one on PQMethod Software for Q correlation analysis in a statistical network and factoring tasks (Centroid Factor Analysis, Q Varimax, and final factor selection).

With the uses of the abovementioned Q instruments and PQMethod Software, Study 1 finally resulted in showing the three final factors between all 51 participants’ mindsets of the study and were named as “The Developing Professional”, “The Adaptable Classroom Practitioner”, and “The Caring-sharing Teacher” respectively. Each of them showed similar mindset statement groups about teaching competences from the participants and ranked into top six statements and bottom six statements. Tables 4 to 6 show the three final factors from Study 1 investigating pre-service EFL teachers’ mindsets about teaching competences (Irie et. al., 2018).

**Table 4.** Factor 1 The developing professional:

The top and bottom ranking statements (Irie et. al., 2018)

Ranking	Item#	Statements
<b>Top 6</b>		
5	7	Creating good student-teacher-relationships.
5	8	Having clear objectives for each lesson.
4	36	Having good pronunciation.
4	17	Providing challenge for one's learners.
4	2	Acting as a mentor to learners.
4	43	Providing an insight into the target language culture.
<b>Bottom 6</b>		
-4	44	Being approachable for learners.
-4	31	Understanding individual learners' needs.
-4	10	Serving as an inspiration for one's learners.
-4	21	Using the target language throughout the lesson.
-5	4	Being warm-hearted with learners.
-5	16	Remembering the names of learners.

**Table 5.** Factor 2 The adaptable classroom practitioner:

The top and bottom ranking statements (Irie et. al., 2018)

Ranking	Item#	Statements
<b>Top 6</b>		
5	15	Being flexible in one's teaching.
5	42	Developing materials to supplement the textbook.
4	31	Understanding individual learners' needs.
4	28	Praising learners appropriately.
4	11	Explaining language in more than one way.
4	45	Taking learners' concerns seriously.
<b>Bottom 6</b>		
-4	6	Having a good sense of humour in class.
-4	20	Reflecting on one's own teaching.
-4	37	Having an understanding of the details of language.
-4	35	Being kind to learners.
-5	18	Being patient with learners.
-5	27	Promoting critical thinking skills in one's learner

**Table 6.** Factor 3 The Caring-sharing Teacher:

The top and bottom ranking statements (Irie et. al., 2018)

Ranking	Item#	Statements
<b>Top 6</b>		
5	4	Being warm-hearted with learners.
5	21	Using the target language throughout the lesson.
4	6	Having a good sense of humour in class.
4	7	Creating good student-teacher-relationships.
4	8	Having clear objectives for each lesson.
4	2	Acting as a mentor to learners.
<b>Bottom 6</b>		
-4	30	Being well organized in one's professional work.
-4	36	Having good pronunciation.
-4	24	Encouraging learners to speak without worrying about mistakes.
-4	26	Having good classroom management skills.
-5	43	Providing an insight into the target language culture.
-5	32	Loving one's job.

Although Study 1 did not use an in-depth interview to unpack mindset data more deeply from the participants, the results elicited and grouped similar mindsets about teaching competences from the participants in the way that was much more insightful and significant than those self-report mindset survey questionnaires that could give only a dichotomy view of mindsets.

Study 2, *Exploring pre-service language teachers' mindsets using a sorting activity* (Haukås & Mercer, 2021), adopted the concept of Q methodology to investigate 12 pre-service language teachers' mindsets about teaching competences but adapted Q sorting activities using a simpler procedure. The instruments included a) an online short questionnaire (asking about participants' background, wellbeing, and future selves as language teachers), b) 13 Q descriptive statements about teaching competences selected from 56 Q statements in Study 1 (Irie et. al., 2018), c) a simplified version of Q grid, d) online Q sorting activities, and e) two semi-structured interviews (one before and one after the online Q sorting activities). All of the instruments were used for collecting mindset data from the 12 participants as follows: a short online questionnaire, an interview (about biographies, language learning and teaching beliefs, and wellbeing senses), online Q sorting activities (by putting all 13 Q statements on a 1-6 continuum Q grid scale described with the words "1 = Fixed, cannot be changed" on the leftmost side and "6 = highly changeable" on the rightmost side for participants to express their mindsets about how malleable each of the 13 teaching competence aspects was), and another interview about the reasons behind the Q sorting activities. For data analysis, Study 2 did not use PQMethod Software for Q correlation analysis in a statistical network and factoring tasks (Centroid Factor Analysis, Q Varimax, and final factor selection), but followed the following steps: transcribing interview data with intelligent verbatim transcription, doing the interview coding tasks with NVivo and Atlas tools, manually creating interview themes, and descriptive statistics to find Mean and SD from participants' online Q sorting activities.

With this adapted Q methodology version, Study 2 had the three final mindset themes which were named “Mindset Orientations”, “Mindset Systems of Beliefs”, and “Dynamism of Mindset Orientations”. Each showed participants’ mindsets separately, with values of Mean and SD as well as additional useful mindset data from the interviews. Although Study 2 showed participants’ mindset data as a system of interrelated beliefs between mindset beliefs and other beliefs such as time and experiences, it could not directly group similar mindsets into several factors because PQMethod Software had not been used for mindset data analysis. With the implementation of online Q sorting activities and the two semi-structured interviews, however, this adapted version of Q methodology could help Study 2 investigate its participants’ mindsets much more deeply. According to Haukås and Mercer (2021), The combination of Q sorting tasks and semi-structure interviews allow researchers to tap into the subtle and complex nature of mindsets. This offers evidence that even an adapted version of Q methodology can elicit much more deeply mindset data from participants than those self-report mindset survey questionnaires that could provide a dichotomy view of mindsets only.

Q methodology’s unique characteristics as a mixed research method not only can elicit rich data on mindset through Q sorting activities of Q statements on a Q grid and analyzed with PQMethod Software, but can also investigate reasons behind Q sorts with in-depth interviews – partially exemplified with Study 1 and Study 2. Q methodology has become one of the most promising methods to investigate the complicated nature of mindsets.

#### **4. Summary**

Language mindsets are arguably much more sophisticated than mindsets in other domains. Self-report mindset survey questionnaires can give only a dichotomy view of mindsets. It is essential to implement new methods to investigate mindsets to move away from the limited dichotomy view of questionnaires. Q statements, Q grid, Q sorts, in-depth interviews and with the use of PQMethod Software of Q methodology are a promising method to investigate complicated mindsets. This is supported by the fact that Q methodology has been providing benefits for almost a hundred years in social science and psychology to investigate people’s viewpoints. We hope to encourage researchers to implement Q methodology to elicit a deeper understanding of mindset data and greater insight into language mindset.

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