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RESEARCH COMMENTARY

Sorting Out Equity: The Q-Sort Method in Mathematics Education Research

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In this research commentary, we review the current utilization of the Q-Sort methodology (QM) in mathematics education and provide an example of how Q-Sort can support a more accurate assessment of PSTs' equity beliefs.

KEYWORDS: Qsort, Equity, Pre-service Teacher, Research Methods

Given the complexity of teaching, there is limited time and resources to prepare pre-service teachers with the knowledge and skills needed to promote equity. According to the established literature, we posit that teacher beliefs and mindsets are requisite to future actions in the classroom (Gay, 2010; Ladson-Billings, 2014; Paris & Alim, 2017; Renkly & Bertolini, 2018; Young & Young, 2023). Despite limited exposure to other cultures, the results of prior studies indicate that 96% of pre-service teachers (PSTs) expressed confidence in their abilities to equitably teach a diverse class of students (Saultz et al., 2021). However, prior studies fail to force PSTs to critically reflect on how equity should be actualized in the classroom. Enacting equitable practices requires PSTs to prioritize their beliefs. Current Likert-scaled instruments do not require teachers to prioritize their beliefs. Because Likert-scaled instruments often contain 20 or more items, many participants can become disengaged with the instrument and thus provide superficial or erroneous responses. Data collected in this manner does not provide an accurate or nuanced account of teacher beliefs related to equity in mathematics classrooms.

Accurately assessing PSTs' equity beliefs and disrupting unproductive beliefs through course intervention is crucial to avoiding potential harm that could occur through interactions with vulnerable populations of K-12 learners. An accurate assessment of preservice teacher beliefs should require the participant to prioritize their beliefs by weighting responses in an interdependent manner. This process helps to minimize the measurement bias in the results that can occur when participants choose the middle of the scale (i.e., neither agree nor disagree) or the extremes (i.e., strongly agree or strongly disagree) on a Likert instrument. A Q-Sort is one example of an interdependent scaling method that supports less biased assessments of participant beliefs. However, Q-Sort remains underutilized to assess preservice teachers' equity beliefs. In this research commentary, we first review the current utilization of the Q-Sort methodology (QM) in mathematics education. Then we explore the QM analysis process, concluding with a heuristic example of how Q-Sort can support a more accurate assessment of PSTs' equity beliefs.

The Utilization of Qsort Methodology in Prior Mathematics Education Research

The utilization of the Q sort method in the field of mathematics education reveals several recurring themes and areas of consideration for researchers and teacher educators (see Table 1 below). Several studies examined students' attitudes, perceptions, and experiences in mathematics education (Burke O'Connell et al., 2019 & Chen & Chen, 2017). Burke O'Connell et al. (2019) investigate students' attitudes toward science, mathematics, and technology in lower secondary education. Meanwhile, Chen & Chen (2017) explore the perceptions of using wikis and a messaging app in flipped classrooms, employing descriptive statistics and content analysis to understand technology's role in mathematics education. Understanding students' viewpoints is essential for addressing equity concerns, as it helps identify disparities in access, engagement, and achievement based on factors like gender, socio-economic background, or ethnicity.

Wilburne et al. (2018) and Lim-Ratnam et al. (2022) focused on mathematics teachers' practices and professional development. Wilburne et al. (2018) delve into mathematics teachers' implementation of high-leverage teaching practices, and Lim-Ratnam et al. (2022) apply Q methodology to comprehend the priorities in profiles of teacher reflections. These investigations contribute to creating equitable learning environments by improving teaching quality and promoting reflective practices among educators. Others have focused on specific educational contexts—community colleges and primary schools, respectively (Hock et al., 2015; Wheeler & Montgomery, 2009). Specifically, Hock et al. (2015) aimed to understand primary school students' Van Hiele levels of geometry thinking when learning about shapes and spaces. On the other hand, Wheeler & Montgomery (2009) focused on community college students' views on learning mathematics through the lens of their epistemological beliefs. Examining mathematics education at different levels helps in addressing equity concerns related to educational transitions, ensuring that students receive adequate preparation and support regardless of their starting point. Finally, Chen and Chen (2017) explored the use of technology in mathematics education through the utilization of the QM. This study also has implications for equity as it raises questions about access to technology and whether technology-enhanced learning can bridge gaps in mathematical achievement. Despite the relative importance of these themes, none of these observed studies explicitly address issues of equity and social justice. Hence, we argue that while some themes in Q sort research in mathematics education tangentially touch upon issues of equity and social justice, there is room for more explicit attention to these vital concerns. Future research should actively consider the application of the QM to address and contribute to conducting research that informs mathematics teaching and learning practices that can serve all students effectively.

With respect to the analytic strategies employed, primarily Principal Component Analysis (PCA) and Varimax rotation were used to analyze the data. Chen and Chen (2017) were the sole authors to employ an approach other than PCA; rather, Chen and Chen used descriptive statistics and content analysis to understand technology's role in mathematics education. Collectively, these studies employ Q sort methodology to gain insights into diverse aspects of mathematics education, including student attitudes, epistemological beliefs, teaching practices, technology integration, cognitive development in geometry, and teacher reflections. The utilization of statistical methods like PCA and Varimax rotation helps unravel underlying factors and trends within these areas, contributing to a deeper understanding of mathematics education. In the next section, we provide some best practices for utilizing the QM in mathematics education research.

Table 1
Qsort in Prior Mathematics Education Research

Citation	Purpose	Method	Factors	Implications
Burke O'Connell et al. (2019)	Investigate Students' Attitudes to Science, Mathematics and the Use of Technology in Lower Secondary Education	PCA with Varimax, Variance Explained not provided	Attitudes toward science, mathematics, and technology	Findings can inform educational practices and interventions to improve student attitudes.
Wheeler & Montgomery (2009)	Explore Community College Students' Views on Learning Mathematics in Terms of Their Epistemological Beliefs	PCA with Varimax four factors accounted for 57% of the variance	Epistemological beliefs about learning mathematics	Insights can guide instruction and support for community college students in mathematics

Wilburne et al. (2018)	Examine Mathematics Teachers' Implementation of High-Leverage Teaching Practices	PCA, Variance Explained not provided	High-leverage teaching practices in mathematics	Identify areas for professional development and support for mathematics teachers
Chen & Chen (2017)	Utilize Wikis and a LINE Messaging App in Flipped Classrooms	Descriptive Statistics and Content Analysis	Perceptions of using wikis and a messaging app in flipped classrooms	Inform the design and implementation of technology-supported flipped learning environments
Hock et al. (2015)	Understand Primary School Students' Van Hiele Levels of Geometry Thinking in Learning Shapes and Spaces	PCA with Varimax factors accounted for 56.51% of the variance	Van Hiele levels of geometry thinking	Enhance instructional strategies to support geometry learning at the primary school level
Lim-Ratnam et al. (2022)	Apply Q Methodology to Understand Priorities in Profiles of Teacher Reflections	Varimax factors accounted for 57.6% of the variance	Priorities in teacher reflections	Inform professional development programs and practices for reflective teaching

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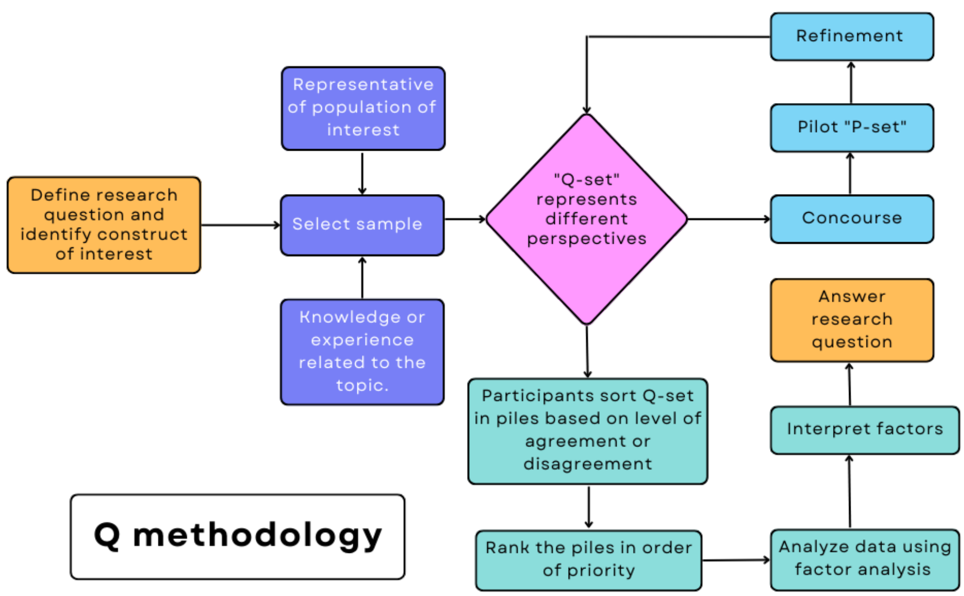
Qsort Analysis

Steps in Qsort Analysis

The QM is a research method that allows researchers to identify the different perspectives that individuals hold on a particular topic. Here are the steps involved in using the QM, as outlined by Lundberg and colleagues (2020):

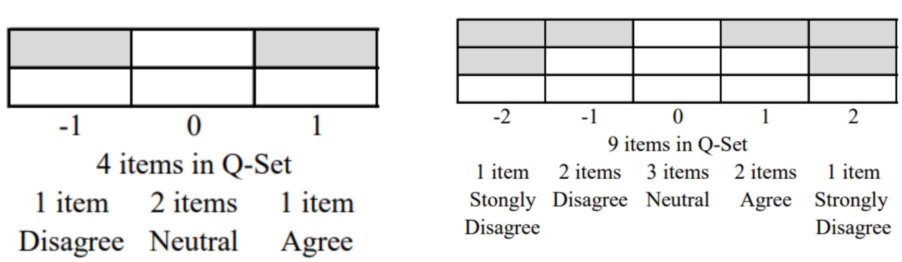


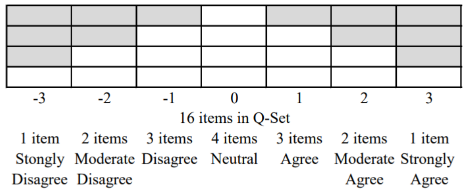
1. **Select the topic:** The first step is to select the topic of interest that you want to study. This could be anything from educational practices to social attitudes. In the six examples presented here, the topics of interest included teacher and student beliefs related to pedagogical practices and mathematics content. These topics of interest are most reflective of educational practices. However, there is a critical need to assess preservice teachers' social attitudes toward issues of equity, diversity, and social justice in the mathematics classroom.
2. **Define the concourse and develop the Q-Set**: In mathematics education research, the concourse and Q-Set are developed through literature reviews, established models/frameworks, and expert panels (Hock et al.,

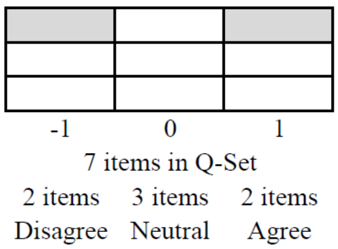
2015; Wilburne et al., 2018). The concourse refers to a set of short and clear statements that represent different perspectives on the topic. Sometimes, it is necessary to develop a "P-Set" or pilot set of statements from the concourse. Typically, the P-Set consists of 40-60 statements. The purpose of the P-Set is to ensure that the final Q-Set is clear, unambiguous, and encompasses the major categories presented in the concourse. The Q-Set statements should be presented in a random order, and the number of statements should be limited to allow participants tosort them within a reasonable amount of time, as per best practice.

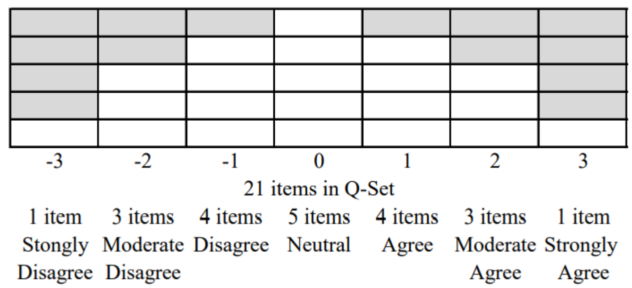
3. **Recruit participants:** Participants should be selected based on the research question and the sampling strategy. The number of participants should be sufficient to ensure that the results are representative of the population of interest. Common participants in prior research ranged from K-12 and post-secondary learners to in-service and pre-service teachers.
4. **Conduct the sorting task**: The Q-Sort task asks participants to sort the Q-Set statements into a quasi-normal distribution (i.e., bell-shaped), with some statements strongly agreed with, some strongly disagreed with, and others falling in between. This sorting process creates a subjective ranking of the statements based on the participant's own viewpoint or perspective. It is important to note that each statement must be placed in a unique position on the bell-shaped Q-Sort grid. For example, Wheeler and Montgomery (2009) used a forced distribution ranking scale of 9 points, with anchors of -4 (least important), 0 (neutral), and +4 (most important). The sorting task can be conducted online using Jamboard or any other online platform that allows you to manipulate digital objects with each statement from the Q-Set written on them. The Q-Sort can also be conducted using physical objects, such as note cards placed on poster board or a predefined grid, as shown in the examples below.

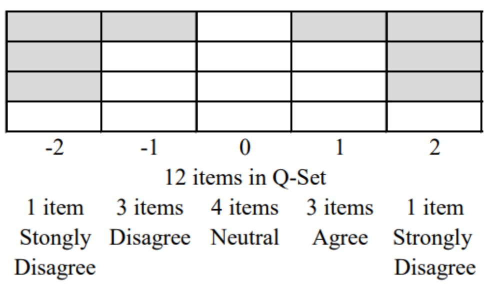
Examples of Normal Q-Grids











5. **Analyze the data**: A common approach to analyzing the results of the sorting process is factor analysis. Researchers can use this technique to identify different clusters of perspectives on math education, gaining insights into how these perspectives relate to teaching and learning practices. Factor analysis is a statistical method that identifies underlying patterns or factors in large data sets. This is achieved by analyzing the correlations between the sorting patterns of different participants. The results of the factor analysis should be interpreted and compared to the existing literature and expert opinions to draw conclusions about the topic of interest. While factor analysis is the most common approach for analyzing Q-Sort data, other approaches have been used in mathematics education research. For example, Chen and Chen (2017) analyzed their Q-Sort data using open and axial coding. Nonetheless, we recommend considering factor analysis as the best practice for Q-Sort data analysis.

6. **Validate the results**: The factor analysis results should be validated using different techniques. Best practices indicate that factor analysis results should be evaluated for validity and reliability by examining the factor loadings, factor structure, factor rotation, inter-rater reliability, and participant feedback. You can also use internal consistency measures such as Cronbach's alpha to assess reliability. This ensures that the results are reliable and valid. Reliability and validity are important. In prior mathematics education studies, researchers have used two approaches. Hock et al. (2015) completed a validity check by reviewing the distribution of participant scores. Wheeler and Montgomery (2009) used an expert panel to assess the construct validity of their results. Future studies should consider incorporating more inter-rater agreement and participant feedback to measure construct validity.
7. **Interpret the results:** Interpret the factor analysis results and draw conclusions about the underlying factors or dimensions that explain the correlation patterns among the statements or items. This process helps unpack the Q-Sort's major themes and outcomes. For instance, a Q-Sort conducted by Wilburne et al (2018) suggests that professional development programs for K-12 mathematics teachers should focus on implementing high-leverage teaching practices. Specifically, the four factors or viewpoints identified in the study were: (1) The Power of Learning, (2) The Power of Questioning, (3) The Power of Collaboration, and (4) The Power of Technology. Ultimately, interpreting the results is arguably the most important part of the Q-Sort process as it leads to the recommendations and implications for the research study.

Overall, the QM is a valuable tool for research in mathematics education as it allows researchers to identify the different perspectives that individuals hold on a particular topic. The steps outlined above provide a framework for conducting QM research and should be followed carefully to ensure that the results are valid and reliable. In the next section, we apply this framework to present an example analysis of a subset of data from a larger study. Our hope is to illustrate how Q-Sort may be used in mathematics education to explore preservice teachers' perspectives on equity practices using NCTM's principles to take action. This is a contrived example presented for instructional and informational use only; thus, these results should not be used to draw conclusions about preservice teacher beliefs. Instead, they should be seen as a methodological exemplar that the reader can use to implement a Q-Sort in their future research projects.

Heuristic Example

Research Context

Courses in mathematics teacher preparation programs are the final step before teachers enter the classroom. Since beliefs have a strong influence on practices, it is critically important to assess and address teacher candidates' perceptions related to effective approaches to achieving equity in the classroom. This Q-Sort research project emerged based on our need to assess teacher candidates' perceptions regarding equity and access. The goal of this project was to assess teacher candidates' beliefs before and after engaging in an equity-focused intervention. For the intervention, we present teacher candidates with representations of practice which we refer to as equity vignettes. The vignettes are based on actual equity-related events addressing controversial issues that practicing teachers have shared with us. Teacher candidates engage in decompositions and approximations of practice surrounding the equity vignettes. Initially, we piloted dichotomous sortings and Likert-scale ratings based on the 16 equity and access beliefs. However, we were dissatisfied with the superficial results we obtained. The researchers decided to apply a Q-Sort approach to require the participant to prioritize their beliefs related to promoting equity in the mathematics classroom.

According to NCTM's (2014) guiding principle of access and equity, "An excellent mathematics program requires that all students have access to a high-quality mathematics curriculum, effective teaching and learning, high expectations, and the support and resources needed to maximize their learning potential" (NCTM, 2014, p. 5). As outlined in Table 1, NCTM identified 8 productive and 8 unproductive beliefs "that influence the access that students have to effective instruction, high-quality curriculum, and differentiated learning supports" (NCTM, 2014, pp. 62-63). We used these 16 beliefs as our Q-Set. We decided to forego the steps of defining a concourse and piloting a P set because these 16 beliefs are endorsed by the leading professional organization in mathematics education. The authors of the equity and access chapter (NCTM, 2014, pp. 59-69) draw on research and literature in the field of mathematics education to support each of their claims (e.g., Battery, 2013; Boaler, 2006, 2011; Darling-Hammond, 2007; Ellis, 2008; Flores, 2007; Gutiérrez, 2002, 2013; Jackson et al., 2013; Schmidt et al., 2011).

Table 1

"Principles to Actions" Beliefs About Access and Equity in Mathematics (NCTM, 2014)

	Unproductive Beliefs	Productive Beliefs
1	Students possess different innate levels of ability in mathematics, and these cannot be changed by instruction. Certain groups or individuals have it while others do not.	Mathematics ability is a function of opportunity, experience, and effort—not of innate intelligence. Mathematics teaching and learning cultivate mathematics abilities. All students are capable of participating and achieving in mathematics, and all deserve support to achieve at the highest levels.
2	Equity is the same as equality. All students need to receive the same learning opportunities so that they can achieve the same academic outcomes.	Equity is attained when students receive the differentiated supports (e.g., time, instruction, curricular materials, programs) necessary to ensure that all students are mathematically successful.
3	Equity is only an issue for schools with racial and ethnic diversity or significant numbers of low-income students.	Equity—ensuring that all students have access to high-quality curriculum, instruction, and the supports that they need to be successful—applies to all settings.
4	Students who are not fluent in the English language are less able to learn mathematics and therefore must be in a separate track for English language learners (ELLs).	Students who are not fluent in English can learn the language of mathematics at grade level or beyond at the same time that they are learning English when appropriate instructional strategies are used.
5	Mathematics learning is independent of students' culture, conditions, and language, and teachers do not need to consider any of these factors to be effective.	Effective mathematics instruction leverages students' culture, conditions, and language to support and enhance mathematics learning.
6	Students living in poverty lack cognitive, emotional, and behavioral characteristics to participate and achieve in mathematics.	Effective teaching practices (e.g., engaging students with challenging tasks, discourse, and open-ended problem solving) have the potential to open up greater opportunities for higher-order thinking and for raising the mathematics achievement of all students, including poor and low-income students.
7	Tracking promotes students' achievement by allowing students to be placed in "homogeneous" classes and groups where they can make the greatest learning gains.	The practice of isolating low-achieving students in low-level or slower-paced mathematics groups should be eliminated.
8	Only high-achieving or gifted students can reason about, make sense of, & persevere in solving challenging math problems.	Effective mathematics instruction leverages students' culture, conditions, and language to support and enhance mathematics learning.

Note. Numbering (1-8) added by the authors of this article.

Participants

The participants in the present study were selected from a convenience sample of preservice teachers enrolled in a mathematics course for elementary teachers. The sample included 49 participants over three semesters. The target population of this study was preservice teachers in the southern United States, which represents the target population of learners for this study.

Conducting the Sorting Tasks

The participants completed the sorting task on an online platform (i.e., Jamboard). The participants were given a week to reflect on a randomized set of the "Beliefs About Access and Equity in Mathematics" (NCTM, 2014). One sample statement was "Students possess different innate levels of ability in mathematics, and these cannot be changed by instruction. Certain groups or individuals have it while others do not." The 16 items were sorted by each student on a forced distribution scale from -3 (least agree) to +3 (most agree) based on the students' perspective. Please see directions and sample Q-Sort below:

"DIRECTIONS:

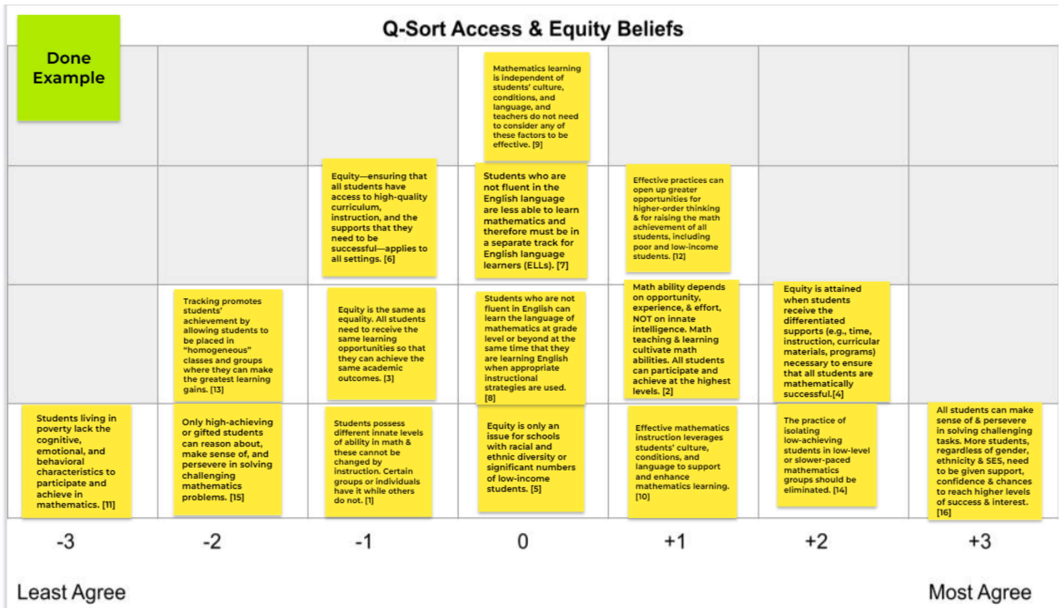
1. Find the sticky note with your 900 number in the top left corner.

2. Read, reflect, and place each belief (there are 16) on the Q-Sort chart based on how much you agree with it + 3 most agree vs. -3 least agree.

3. Use the snipping tool (PC) or Shift, Command, and 4 (MAC) to save your finalized chart to upload in CANVAS in the BEFORE Equity Vignettes Assignment."

Figure 3

Example of Completed Sorting of the 16 items in the Q-Set on the Q-Grid
Sample item from the Q-Set: "Students possess different innate levels of ability in mathematics, and these cannot be changed by instruction. Certain groups or individuals have it while others do not."



Conducting a QsortQ-Sort Using R

The provided code demonstrates how to load the '**qmethod**' package and import data from a CSV file. Here's a breakdown of the code.

```
# Load the package
library(qmethod)
```

This line of code loads the '**qmethod**' package, which provides functions for conducting Q-methodology analysisQM.

```
# Upload your data
mydata <- read.csv('Qsample.csv',
                   header = TRUE, sep = ',', quote = '"')
```

This code reads the data from a CSV file named 'Qsample.csv' and assigns it to the variable '**mydata**.' The '**read.csv()( )'** function is used to read the CSV file, and the function arguments specify the file name, that the file has a header row, the separator (comma), and the quote character (double quotation marks).

The loaded data consists of 16 statements and 10 Q-sorts.Sorts. Each column represents a Q-sortPSTs' rankings of the 16 items in the Q-Set (the rows) with values ranging from -3 to 3, indicating the degree of agreement or disagreement with each statement. The rows represent different individuals or participants who completed the Q-sort.

Here's an example of the loaded data:

	s1	s2	s3	s4	s5	s6	s7	s8	s9	s10
1	-3	-1	-1	-1	-3	0	-2	-1	-1	1
2	2	3	1	2	2	-2	2	3	0	1
3	0	0	0	0	1	2	0	1	2	0
4	1	1	0	1	2	2	1	-1	0	1
5	-1	-1	-3	-3	-1	-2	-3	-2	-2	-1
6	1	0	2	1	3	0	1	0	0	3
7	-2	-2	-1	-1	-2	-1	-1	0	-2	-1
8	-1	1	1	0	1	-3	0	0	2	0
9	-2	-1	-2	-1	-1	0	-2	-1	-1	-2
10	3	2	0	1	0	3	2	1	1	2
11	-1	-2	2	-2	0	-1	-1	-2	-1	-2
12	2	1	0	2	-1	1	3	2	0	0
13	0	0	-2	0	1	0	1	1	1	2
14	0	0	-1	0	0	1	0	0	1	-1
15	0	-3	3	-2	-2	-1	-1	-3	-3	-3
16	1	2	1	3	0	1	0	2	3	0

The data can now be used for further analysis using the '**qmethod'** package functions. After loading the data, the code proceeds to perform the Q-method analysis by calling the '**qmethod'** function. The function takes the data ('**mydata'**) as input, specifies the number of factors to extract ('**nfactors** = 2'), selects the extraction method as Principal Component Analysis ('extraction = PCA'), and chooses varimax rotation ('**rotation** = **varimax**') to facilitate interpretation of the factors. The results of the analysis are stored in the results object.

```
results <- qmethod(mydata, nfactors = 2, extraction = PCA, rotation = varimax)
```

Next, the code generates a plot of the results using the '**plot**' function. The '**results**' object is passed as the argument, and the '**sub**' parameter specifies the subtitle for the plot.

```
plot(results, sub='Plot of statement z-scores')
abline(v=0, col='grey')
```

The code then saves the '**results**' object in R format to a file named 'qm_results.RData' using the '**save**' function.

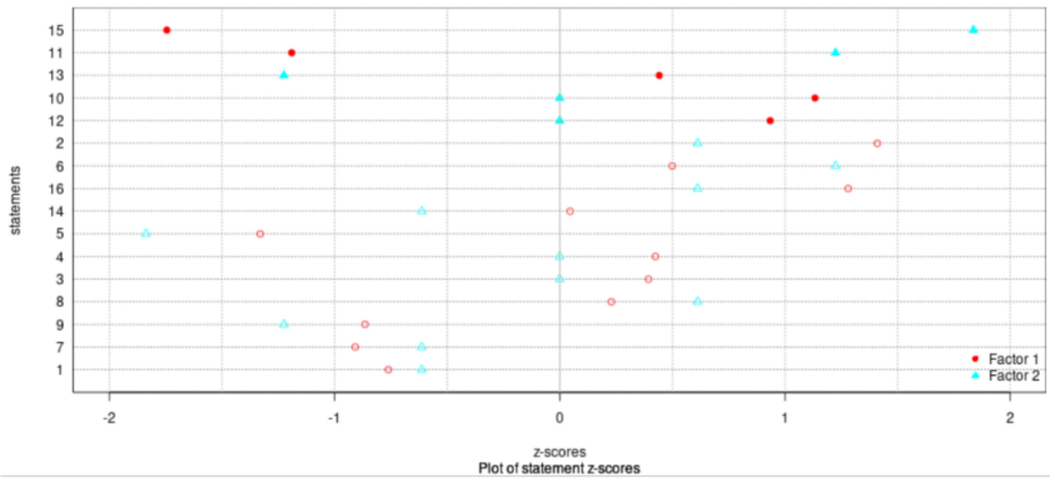
```
save(results, 'qm_results.RData')
```

Finally, the code exports a full report of the Q-method results in plain text format. The '**export.qm**' function is used, which takes the '**results**' object as input, specifies the output file name as 'qm_report.txt', and sets the style of the report as 'PQMethod'.

```
export.qm(results, 'qm_report.txt', style='PQMethod')
```

Figure 4

R Output for **Qsort** *Q-Sort*



Q-method analysis.
Finished on: Wed May 17 17:04:13 2023 'qmethod' package version: 1.8.1
Original data: 16 statements, 10 Q-sorts
Forced distribution: TRUE
Number of factors: 2
Extraction: PCA
Rotation: varimax
Flagging: automatic Correlation coefficient: Pearson

Total variance explained: 69.34 %

Table 2

Correlation Between Factor Z-scores:

	zsc_f1	zsc_f2
zsc_f1	1.00	0.11
zsc_f2	0.11	1.00

Table 3

General Factor Characteristics

Factor	Average Relative Coefficient	Number of Loads	Eigenvalues	Variance Explained	Reliability	SE of Factor Scores
f1	0.80	9	4.90	48.99	0.97	0.16
f2	0.80	1	2.80	20.34	0.80	0.45

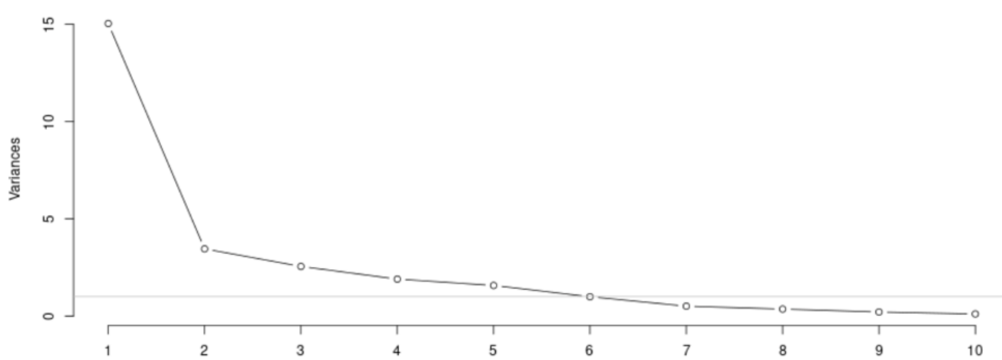
Table 4

Mean and Z-scores for Items Loading on Factor 1

Item	Mean Rating for all PSTs in Data Set	z-score for PSTs described by Factor 1
10	1.444444444	1.25
11	-0.8888888889	-1.35
12	1.111111111	.97
13	0.2222222222	.48
15	-1.333333333	-1.75

Figure 5

Screeplot of Unrotated Factors



Interpretation of the Results

The overall perception of the students included in the Q sort analysis is that effective mathematics teaching can support the mathematics achievement of all students. However, the students believe that ability grouping is an important consideration for maximizing learning gains.

Culturally Relevant Education

Item 10 — "Effective mathematics instruction leverages students' culture, conditions, and language to support and enhance mathematics learning." The PSTs in this project had an overall positive perception of the ability of culturally relevant mathematics instruction to level the academic playing field for all students. This is evidenced by the positive z score of 1.25.

Poverty and Mathematics Achievement

Item 11 — "Students living in poverty lack the cognitive, emotional, and behavioral characteristics to participate and achieve in mathematics." The PSTs generally disagree with the deficit positioning of students experiencing poverty as cognitively, emotionally, or behaviorally incapable of achieving in mathematics. The overall z-score for this item as -1.35.

Item 12 — "Effective teaching practices (e.g., engaging students with challenging tasks, discourse, and open-ended problem solving) have the potential to open up greater opportunities for higher-order thinking and for raising the math achievement of all students, including poor and low-income students." The PSTs perceived effective teaching strategies as a means to raise the achievement of all students with an acute focus on low-income students. The overall z -score for this item was positive (.97). It is important to note that items 11 and 12 are mirrored as unproductive and productive beliefs respectively. These were the only pair of mirrored items to both load on a factor in the Q sort, suggest a very consistent and strong beliefs about the relationship between poverty and mathematics achievement.

Tracking and Student Achievement

Item 13 —Tracking promotes students' achievement by allowing students to be placed in "homogeneous" classes and groups where they can make the greatest learning gains. The PSTs tend to believe that tracking can increase a student's propensity for increased higher-order thinking and raise student success in mathematics. This result is not unknown across prior population of PSTs (Ansalone & Biafora, 2004). This It is important to note that the z-score for this item was positive (.48), thus the PSTs generally agree with an unproductive mathematics belief. However, this was the only unproductive belief that the students agreed with as a group.

Item 15— Only high-achieving or gifted students can reason about, make sense of, and persevere in solving challenging mathematics problems. The PSTs disagree with the unproductive belief that only gifted students have the "math gene". More specifically, because the z score was negative (-1.75) the PSTs believe that all students are capable of engaging in rigorous mathematics. Upon closer inspection we believe that this response contradicts the PSTs stance on tracking, but without additional information it is impossible to determine this conclusively.

Discussion

Assessing perceptions related to equity and access is crucial for promoting equitable practices in mathematics classrooms. However, existing Likert-scaled instruments may not effectively capture the nuanced and prioritized beliefs of study participants. In this research commentary, we propose Q-sort as an alternative to traditional survey research methods. Q-sort presents a valuable alternative for assessing beliefs in a more accurate and comprehensive manner.

In this research commentary, we reviewed the current utilization of QM in mathematics education and provided an example of how Q-sort can support the assessment of PSTs' equity beliefs. By prioritizing beliefs and requiring participants to engage in a sorting task, the Q-sort methodology minimizes measurement bias and provides a more accurate and nuanced assessment of beliefs. Our heuristic example demonstrates how Q-sort can be used to explore PSTs' beliefs before and after an equity-focused intervention. However, it is important to note that the example is contrived (e.g., a subset of a larger dataset) and should not be used to draw conclusions about PSTs' actual beliefs.

Conclusion

In conclusion, the Q-Sort methodology has the potential to enhance the assessment of beliefs in mathematics education. By prioritizing beliefs and minimizing measurement bias, Q-Sort allows for a more accurate understanding of perspectives on equity, access, and other issues pertinent to urban mathematics educators. It is our hope that researchers will consider following the steps outlined in this commentary to implement Q-sort in their future research projects. Further exploration and utilization of Q-sort in mathematics education research can contribute to promoting equitable practices in the classroom and preparing teachers to effectively serve all learners.

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