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BUILDING A SOFTWARE TOOL TO EXPLORE SUBJECTIVITY IN THE CLASSROOM: A DESIGN CASE

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Q methodology provides a unique mixed-methods means of examining subjectivity through the use of an activity called a Q sort in which participants must sort a list of given items within a predetermined sorting form. Although Q methodology has a long history as a research tool, its use as an instructional tool has not been extensively explored. This is unfortunate because the Q sort activity—an element of Q methodology—offers instructors with an evidence-based approach to helping individual students understand their own subjective points of view while also helping to reveal distinctive subjective profiles or perspectives held by all students in the class. One reason why Q sorts may not have been embraced by instructors is perhaps the fact that it is difficult to prepare a Q sort in its traditional, paper-based form. A prototype of a Q sort software tool was built to meet this challenge. The purpose of this paper is to present the story of the current design of this tool. Four categories of design iterations developed over a four-year period are presented and discussed.

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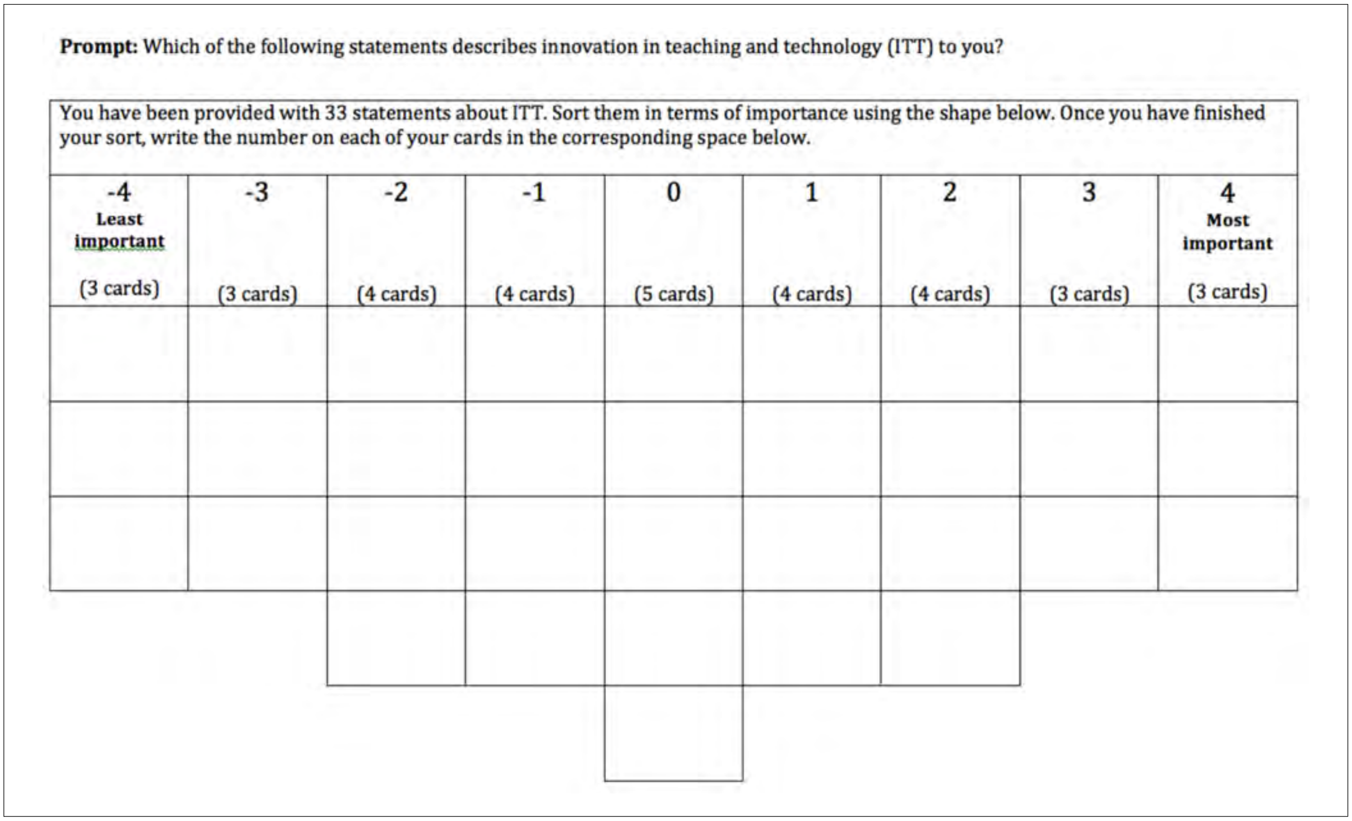
INTRODUCTION

The college classroom is full of subjective experiences for students. The most interesting topics are usually the most provocative (Jagger, 2013). Likewise, the most interesting problems rarely have a definitive solution (Jonassen & Kim, 2010; Marra, Jonassen, Palmer & Luft, 2014). Reflecting on one's own subjectivities and recognizing the diverse points of view of one's classmates on a given topic can lead to many positive outcomes. Students can come to recognize and value diverse points of view while realizing that others do not necessarily share their views. It is also an excellent way to spark interest and curiosity in a student. Of course, surveys can also be good ways to learn about the diversity of student views; however the all-too-popular multiple-choice or Likert-scale question types make it easy for students to answer them without mindful engagement, such as quickly marking every item with the same score (Serfass & Sherman, 2013).

In contrast, Q methodology (Q) offers a very different approach to surveying students about their views with the use of a Q sort. A Q sort requires a participant to arrange a given set of statements into a pre-determined grid that takes the approximate shape of an inverted normal curve (Shemmings, 2006), such as that shown in Figure 1. There are as many slots in the grid as there are statements, thus forcing the participant to subjectively consider the relative value of each statement. Although Q methodology has a long history as a research tool (e.g., Barnes, Angle, & Montgomery, 2015; Pruslow & Red Owl, 2012; Ramlo, 2012; Woods, 2011), little attention has been paid to its usefulness as an instructional tool (Ramlo, 2011, is an exception). Does Q have a role to play in instruction? If so, what are the design challenges to making this happen? This design case is a response to this second question.

The historical roots of Q methodology are in Charles Spearman's work on factor analysis (Child, 2006). The goal of factor analysis is to reduce a group of measurements taken on individuals into a smaller set of related components or factors. This reduction is achieved first by correlating all of the measurements to reveal patterns of association among


Prompt: Which of the following statements describes innovation in teaching and technology (ITT) to you?

You have been provided with 33 statements about ITT. Sort them in terms of importance using the shape below. Once you have finished your sort, write the number on each of your cards in the corresponding space below.

-4 Least important (3 cards)	-3 (3 cards)	-2 (4 cards)	-1 (4 cards)	0 (5 cards)	1 (4 cards)	2 (4 cards)	3 (3 cards)	4 Most important (3 cards)

FIGURE 1. A typical grid layout for a Q sort activity.

them. The label "R methodology"—using the "r" from Pearson correlations—is used to denote traditional factor analysis and all statistical traditions associated with it. Interest in individual differences in the 1930s gave rise to the idea that people, rather than the measurements on them, could be the focus of factor analysis. The idea was to invert the correlation matrix of data to reduce the overall individual responses into profiles of people that share relationships. Early attempts to do so, most notably by Cyril Burt, suffered from statistical difficulties due to the fact that the variables used different measuring units. In the 1930s, Stephenson creatively overcame these inherent statistical problems through the use of the forced-choice method of the Q sort procedure. The solution was to give each individual a predetermined sorting grid that deliberately takes the symmetrical shape of a normal distribution, thus effectively forcing the individual to place the majority of items toward the middle of the form, with fewer and fewer items allowed to be placed along each extreme end. This breakthrough solved the statistical impasse and allowed Stephenson to apply factor analysis principles in the identification of different subjective viewpoints held by a group of people on a given topic (Watts & Stenner, 2012). Qualitative reasoning skills—particularly the use of abductive logic—are needed throughout Q methodology, especially in the interpretation of the viewpoints (i.e. factors).

A comparison between using the Q sort procedure and a Likert-style survey to investigate student views of a given topic helps to reveal unique qualities of Q methodology. Consider the trivial example of personal preferences for ice cream flavors. A typical Likert-style survey might ask the respondent to rate each of 30 ice cream flavors with the following rating scale: 5-"Like very much"; 4-"Like"; 3-"Neutral"; 4-"Dislike"; and 5-"Dislike very much." If the person likes half of the flavors listed, these 15 items will receive a rating of either four or five. A person who likes all ice cream flavors to some degree would give all of the flavors similar ratings, with perhaps a rating of three thrown in a few times. In contrast, the Q sort would also guide students to sort the flavors based on how much they liked each of them, but the poles of the scale would be "Like the most" to "Like the least." Each flavor would receive an individual rating but forced to conform to a rating grid similar to that in Figure 1. Interestingly, even if a respondent loved or hated all of the ice cream flavors, they could still sort the flavors in an order that matched their preferences. The Q sort activity "normalizes" the rating scores of each respondent to make meaningful statistical comparisons between respondents possible. This example also demonstrates an important philosophical distinction between Q methods and R methods (e.g. Likert-type surveys). If the Q sample (i.e. the list of ice cream flavors) accurately represents the range of ice cream flavors possible, then the "observer" shifts from the researcher to the participants themselves. Consequently, the scores are self-referent with no need for measures of reliability or validity as would be needed in R methodology research. This distinction becomes much more evident when we move away from trivial investigations involving ice cream to serious topics such as political identities and equity.

I first became acquainted with Q methodology about five years ago when colleagues and I conducted research about faculty's perceptions about "innovation in teaching and technology" (Kopcha, Rieber, & Walker, 2016). I was directing a college initiative on this topic and wondered what meanings faculty associated with it. I invited a faculty colleague, Dr. T.J. Kopcha, to join the research team. Dr. Kopcha had recently heard about Q methodology and had been wanting to try it, and this research question seemed to be a very good match for it. We conducted the Q sort activity face-to-face with 20 faculty. A total of 33 statements were used in the Q sort. Interestingly, the faculty found forced sorting to be an interesting challenge, and everyone seemed to enjoy the activity. Based on follow-up debriefings and survey responses, faculty reported that the activity gave them interesting insights about the topic. It occurred to me then that the Q sort activity could be a useful tool in my teaching.

I tried the Q sort activity in one of my face-to-face classes shortly thereafter, using the same 33 statements used in the research. Although the activity was generally well-received by the participants they felt not having immediate group results from the Q sort was a problem. Also, the amount of time it took to prepare, administer, and manage all the paper-based materials was considerable. Due to these difficulties I was not motivated to try using another paper-based Q sort in my teaching despite my continued interest in the concept. I began to wonder if it might be possible to program an electronic version of the Q sort activity.

In April 2015, I decided to begin building my own Q sort software. I began testing an early prototype—titled simply *Lloyd's Q Sort Tool*—in one of my design courses in the summer of 2015. Since then, there have been eight significant iterations of the tool. I have also designed an instructional approach for using the tool in my teaching, an approach that also has evolved over time.

The biggest initial challenge to creating an electronic Q sort tool is the limited space available on a computer screen. In a paper-based Q sort, it is common for a single participant to use the space of an entire table while completing the sort. Much space is needed for the participants to move the statements around, first in preliminary groups of "high, neutral, and low," then moving them into the desired positions on the Q sort grid. Existing online Q sort tools deal with the problem of limited screen space by modifying the Q sort experience. For example, participants are first presented with each statement in isolation and asked to place it in one of the three preliminary groupings. Next, each of the three groups of statements are then presented to the participants, one statement at a time, for the final sort. The criticism of this approach is that the participant never actually sees all of the statements at one time, as originally described by Stephenson for a paper-based sort.

The purpose of this paper is to tell the story of designing Lloyd's Q Sort tool. There are two aspects to this design problem. The first is technical: How to represent the Q sort activity adequately and with fidelity in an online format. The second is pedagogical: How to integrate the Q sort activity appropriately into instruction to fully capitalize on its ability to reveal individual and group subjectivities about a given topic. The technical challenges to building the tool dominated the design in the beginning, but soon after testing the prototype with students in my courses, technical design and pedagogical design became intertwined, like the double-helix of DNA. I focus the discussion in this paper on the technical design of the software tool. However, I briefly describe the pedagogical design and issues surrounding it to provide appropriate context for the use of the software tool.

DESIGN CASES AND DESIGN THINKING

A design case study tells the story of how a design evolves over time. Design cases are needed in education much in the same way as they are needed in other design activities, such as music and art. They provide critical examples for other designers to study in order to inform future designs (Howard, Boling, Rowland, & Smith, 2012). A mistake that is often made in reporting a design case study is to use an analysis of participant data as the results. But, as Howard (2011) points out, "...if there was any 'result' from a design case, it would be the design itself... ." For this reason, the main result to be shared in this paper is the evolution of the design of *Lloyd's Q Sort Tool*.

There are many models of the design process. The field of learning, design, and technology has a long history of instructional design models, with many variations to meet the needs of specific design contexts. However, this design case largely followed the general design model advocated by Stanford's d School (https://dschool.stanford.edu/). This model comprises the following five stages: Empathize, Design, Ideate, Prototype, and Test. Empathizing with the user is arguably the most important element of design thinking. The ability to create and test prototypes of a design largely depends on being able to take the perspective of the user. In this project, user data were collected using formative evaluation procedures I followed while field-testing each of the prototypes. These evaluations took place at the beginning exclusively in my own teaching at the University of Georgia (UGA), both in face-to-face and online courses. All of these courses were at the graduate level. Later, field tests were conducted in various undergraduate classes in the College of Education and the College of Public Health at UGA.

Results of those field tests have been reported elsewhere (Rieber, 2019). In short, participants reported enjoying the Q sort activity and thought it was an excellent way of learning about the topic of the Q sort. Participants also overwhelming reported that the early prototype of the software tool was easy to use and navigate. I also kept a detailed design journal documenting the design as it evolved and wrote about the project in a blog. All of these data were used to support the design story presented in this paper.

It is always useful to reflect on the principles that guide the original design of a prototype. One starts with either a blank sheet of paper or possibly a blank computer screen. If the design is similar to something designed previously, such as yet another PowerPoint presentation for teaching or a conference, then the previous effort likely guides the design process. However, if the design is for something totally new, the first design can seem to emerge somewhat mysteriously from the creative process. In the design-based research literature, Sandoval (2013) recommends making these initial principles as explicit as possible before the design process begins, then continuing to modify the principles as the project proceeds, a process he calls "conjecture mapping." He defines conjecture mapping as "a means of specifying theoretically salient features of a learning environment design and mapping out how they are predicted to work together to produce desired outcomes" (p. 2). The starting point for conjecture mapping is the writing of high-level conjectures where the designer states as explicitly as possible their own theories of learning or behavior related to the problem.

It is important to note that a Q sort is but one part of Q methodology. Given that my interest was to adapt the Q sort activity for instructional uses, my initial design was only influenced by the particulars of the Q sort activity itself. Here are six high-level conjectures that informed my initial design of *Lloyd's Q Sort Tool*:

- A digital version of a Q sort activity needs to be compatible with the origins and intent of the paper-based Q sort activity, as laid out by William Stephenson.
- The Q sort activity has the potential to have a game-like quality to it—under the right circumstances, the task is both challenging and intriguing with a clear goal.
- Students come to class with opinions, but many are often reticent to share them. They would welcome an activity that they perceive as non-threatening and objective to allow them to share their opinions.
- Students want closure after completing an activity, and closure is aided by receiving immediate credible results, a summary, or an interpretation of the activity.
- Reviewing credible results, a summary, or an interpretation of the activity soon after the activity is completed will motivate students to discuss the activity further.
- A teacher must not only see value in conducting a Q sort in their classroom but, with some training, must also come to see implementing the activity as routine. That is, the time and effort they perceive as needed to implement a Q sort must be considered ordinary and reasonable.

ITERATIVE DESIGN OF *LLOYD'S Q SORT TOOL*

There have been eight major iterations of the design of *Lloyd's Q Sort Tool*. As indicated by my first high-level conjecture, the design of the first version was influenced by a desire to mimic the original paper-based version of the Q sort. This includes making sure participants have full access to all of the statements at any moment during the activity. All along the way, design decisions were informed by constraints—and opportunities—offered by the digital environment coupled with participant data collected during the field tests. Changes to early iterations were particularly informed by participant usability data. Interestingly, the first version was field-tested with graduate students in a beginning design course. This gave me the opportunity to share my first crude prototype with them in the context of modeling the design process. As a consequence, the students had a higher tolerance for low fidelity prototypes than they might have had ordinarily.

A good example of how the students' feedback on an early prototype led quickly to improved design was the difficulty many reported in being able to read the statements due to the small font size. This led to an immediate design change giving the user a way to change the magnification of the text. I also collected data by observing students use early prototypes in face-to-face classroom settings, followed by discussions of their experience. Data were also collected as part of the Q sort activity itself, such as the list of statements generated by the students in a class and the individual sorts that followed. These offered evidence of the seriousness of the participants in completing the activity.

All of the design iterations can be grouped into four main categories of iterations. These are outlined and summarized next.

First Vertical Sort Design

The initial design challenge was how to deal with the limited screen space. I was determined not to resort to the strategy common in other digital Q sort tools of requiring the user to sort each statement *in isolation from the other statements* first into three general groups. My first design breakthrough was moving away from the traditional Q sort grid configuration shown in Figure 1 (an inverted normal curve) to a vertical configuration shown in Figure 2. This configuration opened the majority of the window up for the statements to be displayed. This design, however, limited the Q sort to about 20 medium length statements. A large number

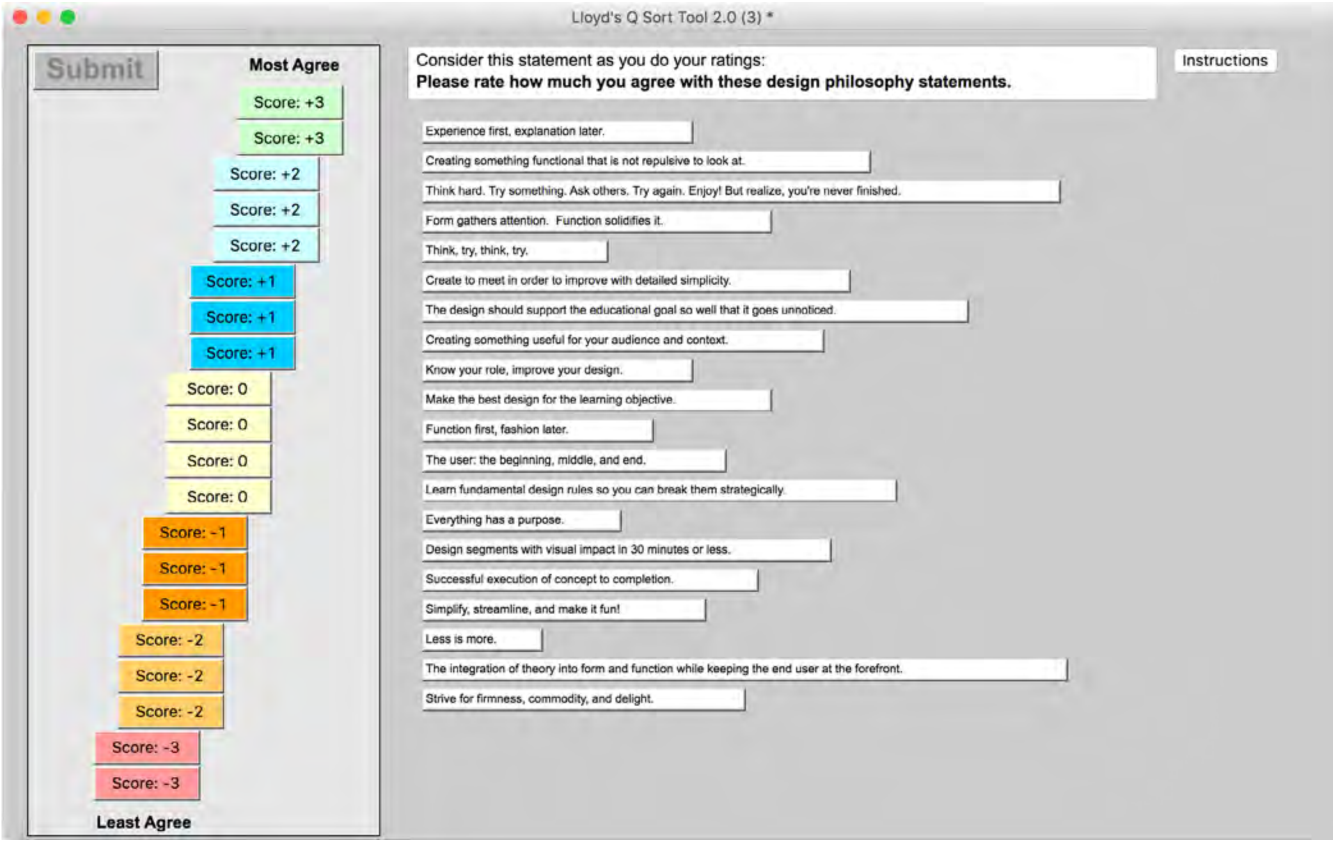


FIGURE 2. The first iteration of Lloyd's Q Sort Tool using a vertical design of the statement slots.

of improvements were made to this design to enhance its usability, such as the text magnification option already discussed.

An advantage of this vertical design over the traditional horizontal design shown in Figure 1 is the natural mapping of statements displayed toward the top as being perceived intuitively more positively than those shown at the bottom. However, the inability to have more than about 20 statements remained a significant limitation.

Real-Time Analysis of the Data

As already mentioned, the analysis of data in Q begins with factor analysis. This is a sophisticated and complex statistical analysis. At the time I first began designing this software tool, the available Q analysis software was limited to software packages with mainframe-like interfaces. Doing even a preliminary analysis with these Q analysis packages can take hours. In contrast, for a classroom discussion to take place in a timely fashion, I needed to have suitable results much more quickly. Consequently, I decided to compute some useful descriptive statistics for easy and quick classroom use. It is important to stress that these descriptive statistics and analyses do not constitute factor analysis.

Although my earliest prototypes collected data and saved them to a web server, I had to download the data into a spreadsheet and then do a manual analysis. Although I eventually managed to complete the analysis quickly (in about 15 minutes), this became a bottleneck for the implementation of the Q sort in a class setting. To counter this, I first created a special instructor app that did an analysis in real-time. I was able to immediately use this instructor app to download the data and then perform an analysis immediately after all participants had completed the Q sort. As I field-tested the use of the Q sort tool with my online classes, I decided to add this analysis function to the Q sort tool itself. This allowed students to check the results themselves. The real-time analysis provides a variety of statistics. For example, the overall raw scores of individual statements are given along with frequency data about how many students gave a particular statement their highest or lowest rating. Statements for which some students gave their highest rating and other students gave their lowest rating are prime candidates for a class discussion because there are obviously wide differences of opinion. The software tool also computes the standard deviation (SD) for each statement to serve as a proxy for the group's overall agreement with the statement (i.e. a low SD indicates the group was, relatively speaking, more in agreement with the statement than a statement that had a high SD). Lastly, an option titled "Are You Like Me?" was added to provide a correlation matrix showing the correlations between all student pairs. Students click on their public names to see their correlations with all other students.

Interestingly, more Q analysis software packages have become available since I first began this project. The most notable is the Ken-Q Analysis software. This software is available in both desktop and web-based formats and has a modern, user-friendly interface. A preliminary Q analysis can be done quickly by someone trained and skilled in factor analysis. I added an option to my software tool to export the Q sort data for use in the Ken-Q software. I am now able to do a preliminary factor analysis—without interpretation—in under 15 minutes.

Second Vertical Sort Design

Given that Q sorts typically have anywhere between 30-70 statements, the first vertical sort design's limitation of 20 statements remained a significant constraint until another breakthrough was made. The first vertical design stacked the statement slots one upon the other, with no multiple slots in any one row. This was an inefficient use of screen space. The breakthrough coincided with my own increased programming skills. I was able to shrink the statement to the size of a small square as the participant moved a statement into one of the slots on the Q sort grid. When the participant moused over the small square, the statement would immediately magnify to show the entire statement. This allowed the number of slots to be increased to up to about 50, depending on the length of the statement, as shown in Figure 3.

Preliminary Grouping Design

As previously mentioned, in a paper-based Q sort, participants are encouraged to do a preliminary sorting into three general groups while always having access to the complete set of statements. I came up with a strategy for this preliminary sort, but while also making sure all statements remained visible on the screen at all times. I created a "sandbox" space at the top of the screen for users to group the statements. When the statement is dropped in the sandbox, it shrinks to a small square. But, the statement number appears in the square, acting as an important reference to the statement. Once all of the statements are in the sandbox, three arrows appear at the far right edge of the sandbox with one arrow in each of the grouping rows. When the user clicks one of those arrows, the statements in that group row move to the main screen in their original size, as shown in Figure 4. Furthermore, the statements appear from top to bottom in the same order they appeared from left to right in the sandbox. The user then can move just those statements to the Q sort grid slots.

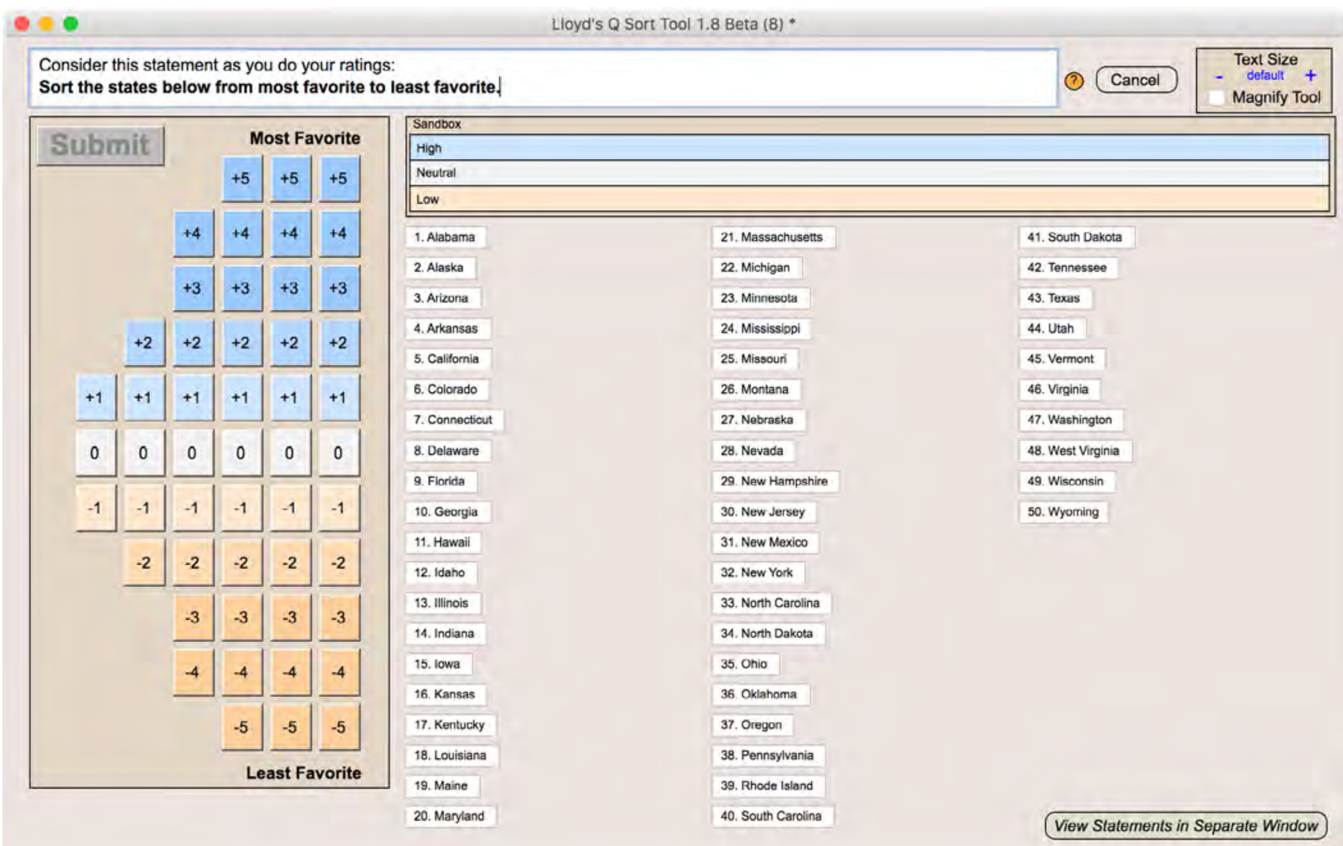


FIGURE 3. The most recent iteration of Lloyd's Q Sort Tool using a vertical redesign design of the statement slots allowing for up to about 50 statements, depending on their length.

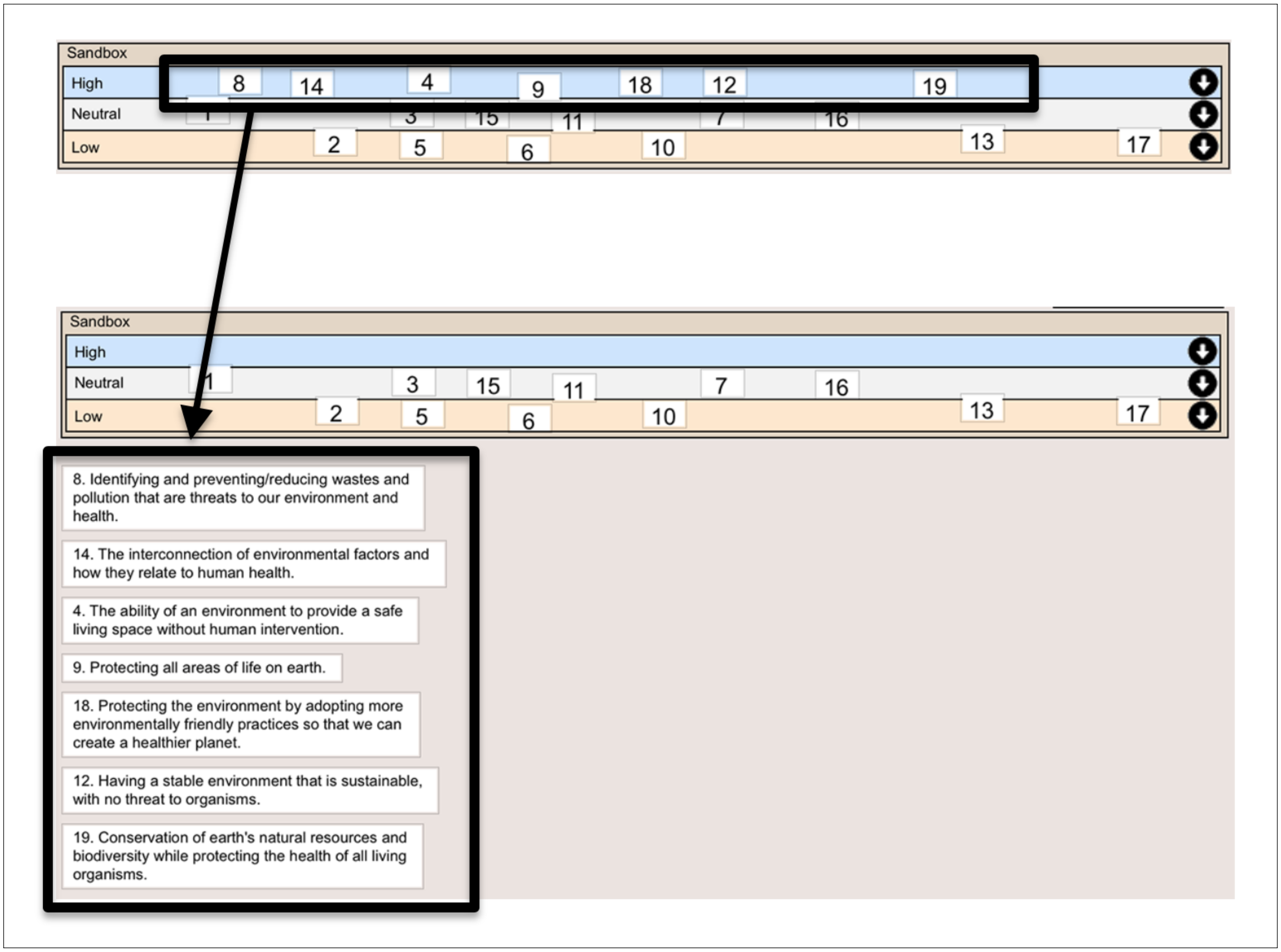


FIGURE 4. A close-up of the sandbox feature where users first sort the statements into three groupings. The three small arrows on the right only appear when the user moves all of the statements to one of the three rows of the sandbox. Then, when the user clicks one of the arrows, the statements in that row are moved down into the main screen area in expanded form and in the same order as shown on the row.

I consider this grouping strategy to be one of the most significant design modifications to the software tool for several reasons. First, doing the preliminary sorting all of the statements into three general groups is considered a very important step within Q methodology. My modification scaffolds this grouping activity in a clean, minimalist way. As statements are moved to the sandbox area, the screen becomes less and less cluttered. After moving all of the statements into the sandbox area, the user then chooses to focus on any one of the three preliminary groups. This subgroup of statements can be considered fully with ample screen space to do so. Second, the preliminary sort is achieved while maintaining full access to all of the statements during the activity, albeit in the collapsed form of the small numbered square with the full statement appearing when the user mouses over any of the squares. To assist the user further in accessing all of the statements, another option was added to show a list of the statements in a separate window. This list includes the number of the statement, thereby making it possible for the user to cross-reference any numbered square with the full statement. Third, the graphic design of the "sandbox" also helps to scaffold the activity based on its visual design. Beyond just facilitating this preliminary sort, this design also encourages users to place statements in each of the three groups in a general order of preference along the horizontal ribbon of each of the three sandbox's groups. As already mentioned, this preference is then preserved when the user clicks the small arrow, and the statements are moved down into the main portion of the screen, fully expanded. Each statement appears in the order (top to down); they appeared in the sandbox (left to right). This priority ordering appears to be a unique design feature in Q methodology.

In summary, the design of the many Q sort software prototypes followed the classic "hill-climbing" metaphor (Norman, 2013). Each improvement was like taking one step uphill closer to the top. There were no catastrophic failures (i.e.

falling off a cliff or into a crevice). The current prototype represents reaching a summit, though many more will likely be climbed in the future.

DEVELOPING AN ACCOMPANYING INSTRUCTIONAL STRATEGY

As I built and implemented prototypes of *Lloyd's Q Sort Tool* with graduate students in my assigned courses, an instructional strategy for its use emerged through this field testing. I have subsequently used this instructional strategy in courses beyond those I teach in collaboration with instructors in environmental health education and social studies education. The strategy is comprised of the following four components or stages:

1. Students are given a simple one-item open-response survey prompting them to reflect on a course topic.
2. The resulting list of statements submitted by students is edited by the instructor (mainly to remove redundancies). The instructor is free to add other statements based on experience, the literature, or statements collected from students during previous courses in order to represent other important views not contained in the original list.
3. The Q sort activity is presented to students using the edited list of statements. Just reading the statements offers the potential to inform students of the range of opinions in the group. The act of sorting the statements helps each student to reflect on their subjective attitudes about the topic, as evidenced by their own sort results.
4. The quantitative results of the group's Q sorts give students strong evidence of the group's thinking, thereby motivating them to hold a meaningful discussion. Interpretation of the results is best done by the students through discussion, but guided by the instructor.

Among the most important questions in Q methodology is where do the statements for the Q sort come from? The answer relates to a key theoretical concept in Q methodology called the *concourse*. A concourse is essentially everything that can be communicated about a particular topic. Some concourses can be finite and bounded, such as a list of all presidents of the United States. However, most topics have concourses that are infinite and boundless. Consequently, a concourse is represented by a sample of statements, called the Q sample, that reasonably and practically reflects the main perspectives contained in the concourse. One strategy for constructing a Q sample is to solicit perspectives on a topic from a targeted group of people.

One example of how this was achieved in this design case is offered next. The example involved an online graduate course titled "Instructional Design for Teachers." As the course title suggests, the participants were all full-time K12 teachers taking a course on instructional design. Participants were asked to complete a simple survey asking the following single open-ended question:

> *"What does 'instructional design for teachers' mean to you? To answer this question, you might find it helpful to just finish the sentence 'To me, instructional design for teachers' means...' as your response.'"*

Interestingly, the student responses were all very positive, so I added four statements that represented other views, a step encouraged in Q methodology in order to ensure that the concourse is more faithfully represented (see Table 1). Some minor editing was done to the participants' responses, but the final wording remained essentially in the students' voice. Students were carefully guided not to try to come up with the "correct answer" based on any of their readings, but instead offer a statement that reflected their own unique perspective. This result alone represents a rich source of data on student thinking. The Q sort activity was then conducted. The online format of the course required a different approach to holding a class discussion. I initiated an asynchronous discussion by posting to a discussion forum a short video of myself discussing the results and posing some interpretation. Students then posted their thoughts and comments. This course also featured a synchronous "virtual" classroom where the discussion was continued.

REVIEW OF THE USER EXPERIENCE IN USING *LLOYD'S Q SORT TOOL*

It is helpful at this point to review the entire experience of a student using the software tool, along with some idea of the tasks and responsibilities of the instructor. I use the word "instructor" frequently in this section because this tool is designed to be used by others without needing me, the developer, to be by their side. Figure 5 outlines the sequence of the user (student) experience.

It is important to note the work required by the instructor to get to the point where the student begins the Q sort activity using the software tool. As already discussed, the instructor is responsible for developing the list of statements. Once the final statements for the Q sort have been identified, the rest of the "conditions of instruction" need to be defined, such as the prompts given to the student and the labels for the Q sort scale (e.g., most agree, and least agree). All of this information must be entered into the online database via a web-based portal. The instructor also needs to create a unique code for each Q sort activity. This code is very important. It is used to query the database to retrieve the correct Q sort information. This code is then given out to the students—they are prompted to enter the code on the start-up screen of the software tool. Likewise, the instructor uses this code to review the results of any Q sort.

- Considering the overall goal of the unit in every aspect of the lesson.
- A way to organize your lessons to not only make them applicable, but interesting to the student.
- **In the end, more regimented and less creative instruction.**
- Taking the time to think critically about your lessons to ensure you are teaching students the objectives rather than the test.
- Designing a course to achieve the goals of the students instead of the intent of the instructor.
- Planning and organizing an engaging lesson for students.
- **A necessary, but not sufficient approach to designing effective and creative instruction.**
- Careful planning of content, delivery, activities, and assessment that are aligned with goals and objectives.
- An organized way to plan meaningful lessons.
- Planning ahead (and circling back often) to intentionally connect goals to assessments to learning activities.
- Thinking about the end goal before creating the tasks to develop the knowledge needed.
- Creating high-quality learning experiences that are outcome-driven and engaging.
- Tapping into one's creativity in order to unlock a classroom's greater potential.
- Planning, implementing, evaluating, and revising meaningful activities to help students master content.
- The building blocks for good planning and good teaching and learning.
- Planning, deeply thinking, organizing, and creating the best possible lessons to achieve a goal.
- How teachers design and revise lessons to ensure their teaching is effective for students.
- **Alignment, alignment, alignment.**
- You align goals, objectives, assessments, and lessons for students.
- Using a systematic and systemic process for curriculum deconstruction, aligned assessments, and innovative instructional strategies that boost student achievement outcomes.
- **Good and important ideas, but not realistic for the challenges that today's teachers face.**
- Being intentional about the objectives, assessment, instruction, and media associated with each lesson for each learner.

Note: The participants' responses all reflected positive attitudes about the topic, so I added the four statements (shown in boldface) to reflect a broader representation of perspectives.

TABLE 1. Graduate student responses to the question "In 15 words or less, what does 'instructional design for teachers' mean to you?"

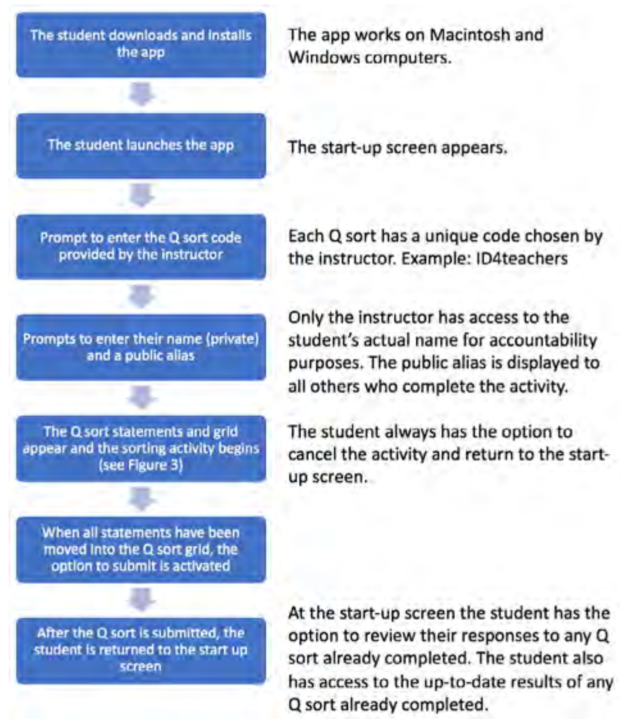


FIGURE 5. A step-by-step account of a student using the software tool.

I designed both the software tool and the instructional strategy for use in both face-to-face and online courses as this matches my own teaching contexts. I follow the instructional strategy faithfully in both contexts, but there are differences. In an online course, the Q sort will likely need to be conducted asynchronously over a period of days in order for the instructor to guide the students to complete the activity one step at a time. For example, one step is just guiding students to download and install the app, followed by completing a fun Q sort. This gives online students the opportunity to report problems or ask questions before a serious Q sort activity is conducted. Likewise, the class discussion will likely be conducted in an online discussion forum unless live classes (held online or face-to-face) are held periodically. In a face-to-face course, the Q sort can be conducted during class so long as each student has access to a computer. If there are not sufficient computers available, the software tool has a "kiosk" option to allow an instructor to set up one or more computers in the room in order to have students complete the Q sort in rotation. It is important for the instructor to lead the class in an overview of the Q sort results. Knowing the results motivates students to want to discuss the results. I have found the best way to do this in an online class is by creating a screencast video recording of my own review of the results.

In both online and face-to-face contexts, it is important not to underestimate the importance of the very first Q sort the students experience. This is likely the first time a student has been asked to complete a Q sort. I have found it is best first to conduct a practice Q sort on a topic that is not too controversial. This will introduce and orient the students to the Q sort activity. Also, if at all possible, this first Q sort is best done using a paper-based format. This is an ironic suggestion given the original premise for building a software tool, namely that it is time-consuming to create the needed paper-based materials for a Q sort. However, the simplicity and uniqueness of the sorting activity is enhanced by first introducing it to students coupled with the tactile feel of moving slips or paper or cardboard around on a tabletop. Understanding how to do a Q sort is much more intuitive when done with paper. Once students have completed a paper-based Q sort, the transition to the software tool is quite easy. Obviously, the instructor will need to take the time to produce enough copies of the paper-based materials, but these can be reused in future classes if the topic chosen has broad relevance and appeal. Obviously, doing a paper sort first in an online course is not practical. If a student's first Q sort experience is with the software tool, the instructor needs to provide special attention and sufficient time to make sure it goes well. Online instructors won't have the advantage of being able to provide quick help or advice to students with a confused look on their faces. I have prepared short video demonstrations to introduce the Q sort activity to students, which have been particularly important and useful in online courses.

SUMMARY

Although Q methodology has a long history as a research tool, its use as an instructional tool has rarely been explored. This is most likely due to the difficulty in preparing and executing the Q sorting activity with traditional paper-based approaches in a face-to-face setting. Several attempts at producing an electronic version of a Q sort have been made, but few have sustained implementation. The most notable and successful example of Q software currently available is *Q-Assessor* <http://q-assessor.com/>. However, this is a very expensive commercial product making it largely inaccessible to classroom teachers. Furthermore, all of the available electronic versions of the Q sort focus on its use within research environments, not instructional environments. For these reasons, I designed *Lloyd's Q Sort Tool* with the expressed intent to investigate ways to seamlessly integrate the Q sorting activity within face-to-face and online classrooms. The current version of the software tool makes it possible to rapidly and routinely create, deliver, and score Q sorts for classroom teaching.

From my perspective as the designer, Q methodology offers a powerful approach to anyone wanting to reveal and understand the subjective views of a group of people on a particular topic. I think that any classroom that includes the teaching of topics that naturally trigger different points of view in students would benefit from exploring Q. And what classrooms do not?

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