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Developing Concourse and Selecting a Q Sample: Preparation for a Q study About Urban, American, Middle-School Science Students' Views of Nature

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Abstract: A key aspect of any Q methodology [Q] study is the development of a concourse of communications related to the topic as well as the selection of a Q sample that is in effect a subset of this concourse, representing the range of communications about the topic. The concourse can have many sources including interviews, newspapers, and focus groups. Often, after themes are identified within the concourse, the Q sample is selected using Fisher's Design of Experiments. This article details the development of a concourse of statements emerging from the writings of seventh grade students in an urban school district with a high free and reduced lunch population. These seventh graders were either preparing to participate in a field trip to a local nature center or had recently completed some aspect of that experience. Initially the concourse consisted of 186 statements. Multiple iterations were used to select the Q sample from the concourse and the quality of the student writing was sometimes an issue. Four themes were identified among the items: activity, good student, learning, and nature. The final selection of the 40-item Q sample was balanced among the four themes.

Keywords: disadvantaged students, middle school, nature, urban school, urbanization

Introduction

Most Q methodology studies consist of the following stages: generating a concourse of items that represent the broad communications on the subject; selecting a subset of the concourse called the Q sample that captures the range of communications about the topic; having individuals sort the Q sample items into a grid based on their viewpoint; analyzing the sorts via factor analysis and correlation; interpreting the divergent perspectives that are represented by the factors; and determining the consensus among pairs of those factors (Brown (1980); Newman & Ramlo, 2010; Ramlo, 2015). The purpose of this study was to use the language and writings of the population of interest to create a concourse and, subsequently, select a Q sample. That Q sample was then

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used with the next year's class of students to investigate their perspectives about nature and learning, before and after a field trip experience to a university managed wetland area. The original concourse and Q sample focused on maintaining the language of this population of students when reflecting on nature. As William Stephenson wrote in the introduction to Brown (1980), a Q sample provides the ability to perform

> a Q study of anyone, to determine the operant factor structure at issue for the person, and by simple extension to a few others in the same culture, to replace talk by functional information, that is, by facts in the inductive frame of subjective science. One can proceed in this manner to provide understandings in terms of quite small numbers of individuals, understandings which could not be grasped before by application of questionnaires to thousands of persons…(p. x).

This article details the development of a concourse of statements emerging from the writings of seventh grade students in an urban school district with a high free and reduced lunch population. These seventh graders were either preparing to participate in a field trip to a local nature center or had recently completed some aspect of that experience. Initially the concourse consisted of 186 statements. Multiple iterations were used to select the Q-sample from the concourse.

The article begins with an outline of the background to the illustrative empirical study. That is followed by a description of the steps taken to identify and develop the concourse. The strategic procedures necessary to create a theoretically-structured Q sample are then described, and some conclusions are drawn about the benefits of such a strategy.

Background for the Study

As industrial nations like the U.S. become more urbanized, the ability of those urban populations to come into direct, purposeful contact with nature becomes more difficult. The amount and types of urban residents' nature experiences are driven by both opportunity and inclination. Cox, Hudson, Shanahan, Fuller, and Gaston (2017) found that direct contact with nature, especially intentional such as visits to public parks, was rare for urban dwellers. This is problematic for multiple reasons. Specifically, interactions with nature have been shown to improve science literacy and attitudes toward biodiversity (Sousa, Quintino, Palhas, Rodrigues, & Teixeira, 2016) as well as providing physical and mental health benefits (Cox, et al., 2017; Tardona, Bozeman, & Pierson, 2014).

Sousa et al. (2016) found that providing access and interactive experiences of urban students with a pond habitat and biodiversity enhanced knowledge of environmental education and improved their attitudes towards biodiversity and the environment. Similarly, Tardona, Bozeman and Pierson (2014) brought school children from disadvantaged urban public schools to a nearby Ecological and Historic Preserve in Jacksonville, Florida. The goals of this program included having these children experience the park, culture and history of an indigenous people; experience and learn about nature and ecology; and to better understand the benefits of physical activity. Like our program, these school children interacted with nature through specific educational experiences. The researchers found that educational programs in parks can facilitate engagement with nature and positively impact education related to nature,

history, and health for urban school children. Lawless and Brown (2015) also used environmental simulations to work with urban and suburban middle-school students. Although they stated that environmental sciences can best be studied and understood as coupled human and natural systems, their use of simulations limited the types of interactions with nature, including the health benefits, described by others (Cox, et al., 2017; Sousa et al., 2016; Tardona, Bozeman & Pierson, 2014).

Like the studies by Sousa et al. (2016) and Tardona, Bozeman and Pierson (2014), this study also involves school children from a disadvantaged, urban public school system. It focuses on determining the multiple, divergent perspectives of these school children before and after they visit a nearby field station owned by a local university. Although the study by Sousa et al. (2016) also investigated student perspectives (attitudes) about biodiversity, that study used a Likert-scale survey which did not allow the determining and description of multiple, divergent perspectives. Lawless and Brown (2015) used anonymous written communication by the students to investigate students' interest in STEM careers, future science explorations, and self-efficacy about writing. Like the Sousa et al. (2016) study, however, Lawless and Brown (2015) provide aggregate results without differentiation among the participants and their potentially diverse viewpoints.

The Urban School

The Urban School is designed as a Community Learning Center (CLC) with grades 7-12 in a single building. The Urban School is one of several new CLC schools within a large, urban public school district in the Midwest. Roughly 824 students are enrolled daily. Of that, 93.7% are black, 2.9% are multiracial, and 2.6% are white. The student population is 100% economically disadvantaged (eligible for free or reduced-price lunch or other public assistance), with a 23.6% disability rate. While the Urban School attendance rate is 93.4%, there is 19.6% chronic absenteeism rate as well. The former high school and middle school combined to form this CLC in 2012. In that same year, the CLC adopted a New Tech model of teaching which emphasizes Project Based Learning (PBL) with students.

University Field Station

The University Field Station consists of a wetland and a nature preserve. The University Field Station consists of approximately 105 acres. The Field Station is described as a living laboratory committed to promoting understanding and research of Ohio's wetland environments. Various departments at the University use the Field Station for research and teaching. Over several years, the Field Station and an Urban Middle School have partnered to bring students to the Field Station.

School Partnership

Within the previous grant funding cycle and in the current grant funding cycle, the broadening participation of underrepresented groups involved a partnership between the University, University Field Station, and the Urban School. This study provided an assessment of the Urban School students' experiences based on their views of nature before and after the field trip experience at the University Field Station. Simply providing the rate or descriptions of participation was not considered a sufficient assessment. Program assessment is a necessary aspect of any program. For instance, program assessment allows for informed decision making and can improve the

program's capabilities to meet the needs of stakeholders, including students (McNeil, Newman, & Steinhauser, 2005). Ramlo (2015) described how Q methodology provides the ability to differentiate program effectiveness among stakeholders. Thus, to differentiate the student viewpoints before and after their field trip and PBL experience, the researchers chose Q methodology. As McKeown (2001) discussed, the use of Likert-scale surveys results in a loss of meaning. Instead, he states that Q offers the ability to rectify this problem while providing the ability to describe each perspective that emerges.

The statements collected for the concourse development came from this previous grant funding cycle partnership. Thus, the concourse was derived from the documents and artifacts from a previous cohort of students at the Urban School who were also in the 7th grade. Like the current study, students who participated in the development of the concourse visited the University Field Station to learn about wetlands, species diversity, pollination ecology, and the environment. The next section discusses the origins of the documents and artifacts from the initial cohort of Urban School students as well as the development of the concourse.

Development of the Concourse

Statements from seventh grade students at the Urban School came from multiple sources (e.g. student applications to the program and post-program reflections). Specifically, prior to the field trip, students had to apply by writing essays regarding why they were good candidates to participate in the trip. Specific prompts were offered to help these students write their essays. Students were filmed by a professional videographer while at the wetland. As part of that film's design, students were asked questions to investigate student empowerment through film and the researchers had access to these videos.. As part of the project-based learning (PBL) design of the educational experience, students made presentations about their field trip experiences. Within PBL, students engage in critical thinking related to authentic (rather than theoretical) learning situations and often present on their experiences while critiquing the presentations of other students. The audience for these presentations included other students as well as community members, who acted as judges of the projects and presentations. Additionally, students responded to various prompts after their field trip experience.

Student responses were collected electronically following the field trips and after student presentations. Students responded to multiple choice and open-ended questions via a Google Forms survey. These questions pertained to the students' field trip experiences and to the students' presentations.

Student writing aptitude varied broadly. In some cases, statements had to be rewritten by one of the researchers to correct grammatical and spelling errors as well as clarify meaning (many sentences were not complete, and the prompt or subject was not obvious as a stand-alone statement). These changes were made after the initial development of the concourse but prior to the selection of the Q sample. Additionally, some statements were factual rather than expressing opinion and those were rewritten as well. For example, a student may have stated that they learned about the history of the wetlands (fact). Such a statement would be rewritten to reflect their enjoyment of learning about the history of the wetlands (opinion). Table 1 contains several samples of student writing to help communicate the range in quality of writing of the 7th grade

students and how some statements were reworded to improve grammar, spelling, or clarity or to become a subjective, rather than objective, statement.

Table 1: Writing Samples From 7th Graders From the Urban School in Response to Prompts

Prompt	Lower quality writing example	Higher quality writing example
Post-video survey	I felt great because I got to meet people that has a long history and a great land.	It makes me feel happy because the wetland people came out and taught us about what lived in the wetland a long time ago.
	mad becouse i was not in it.	I feel mad when I don't get to go on a field trip with my class.
	it made me fell like a smart kid	I like to feel like a smart kid.
Post-presentation survey	I felt great because I got to meet people that has a long history and a great land.	I feel great when I meet people who talk about the history of this area.
	It nice they showed you how to make it better and tell you what you did go. I get to show people how i think my experience was	I learned that you should never be scared to talk to the judges and tell them what you did on your project.
	how much wetlands help our community look how it does today.	Wetlands are important to maintain our communities even in the city.
Why do PBL	how we got to know more about the wetlands and what lives in it.	I would like to learn more about the wetlands and what lives in them.
	I would tell them about the wetlands and the things that is there and what you can here.	It's a good learning experience for the teachers and students.
	that it is fun and you could have time to get to know people in your class and u can have a great make a board	Problem-based learning (PBL) is a good way to get to know people in your class.
	To save wetlands. To restore wetlands for future generations.	It is important to restore the wetlands for future generations.

In summary, the concourse was comprised of 186 statements from the following: essays and question responses regarding why they should be chosen to participate in the field trip (36 statements); post-video survey (50 statements); post-presentation

survey (45 statements); and student responses to why students should do project-based learning (53 statements).

Selection of the Q Sample

With 186 statements in the concourse, a series of stages was used to reduce this concourse to an appropriate Q sample. Experimental design procedures were used to select a Q sample theoretically as suggested by Brown (1970, 1980) using Fisher's experimental design principles. Additionally, the Q sample's structure will provide the investigators with the opportunity to explore the key aspects of the Urban School students' experiences at the University Field Station from the students' perspectives. In other words, selecting the Q sample in terms of a theory or a conceptual framework allows for best ensuring that the selection comprehensively represents the concourse (Brown, 1980).

Furthermore, given the range of strength in writing and perhaps communication in general, simpler statements with a single idea and stated as close as possible to the writings of students were sought. As Graham et al. (2018) indicated, reading and writing abilities are closely linked such that reading instruction can help improve writing. Thus, although some students offered grade-appropriate writings others did not, the researchers decided to provide statement items that would be easily understood by all students participating in the Q sort. Finally, although "most Q samples contain 40 to 50 items and employ a range of +5 to - 5 with a quasi-normal flattened distribution" (Brown, 1980, p. 200), the researchers targeted a Q sample closer to 40 but with a sorting grid range of +4 to -4 to best facilitate the later sorting stage of the study. Again, with so many of the Urban School's students struggling with writing, it seemed prudent to minimize the amount of reading necessary to complete the Q sort.

Initially, each of the 186 statements was recorded in an Excel spreadsheet that included the source of the statement (e.g. post-presentation survey, why do PBL). An initial review led to the elimination of 62 statements based on quality or irrelevance to the Q study. The spreadsheet was used to print the remaining 124 items of the concourse. These statements were cut into individual statements and sorted by hand by the first author who is a Q methodologist. The researcher grouped these statements into piles based on similarities. Four piles emerged each with a different theme. These four themes were: active, good student (characteristics), learning, and nature. Identification of these themes allowed a further reduction in the number of statements because some items did not fit these themes or were similar to other items. This process reduced the 124 to 86. The breakdown across the themes was as follows: Active (14 statements), Good student (16 statements), Learning (21 statements) and Nature (35 statements).

Table 2 – Concourse Reduction of Items: Examples of Items Eliminated and Retained After Theme Identification

Classification	Eliminated	Retained
Active learning	I like to do and see stuff I don't see in my everyday real life.	Problem-based learning (PBL) is a good way to get to know people in your class.

Classification	Eliminated	Retained
	I like doing things like going on field trips and other things like that.	It is fun to do problem-based learning (PBL) sometimes instead of paper and pencil stuff all the time.
Good student	Learning about nature makes me feel like I accomplished something big.	I like to feel like a smart kid.
	I feel good when I can teach others about the stuff I learn on a field trip.	I feel happy when our school is recognized for doing something good.
	I like helping to change the image of my school to one that is more positive.	I feel proud of our school.
Learning	I think problem-based learning (PBL) is hard to do.	I really don't like doing problem-based learning (PBL).
	Problem-based learning (PBL) is fun and helps you learn a lot.	It's important to be engaged in real-world activities when it comes to science.
	Problem-based learning (PBL) is a fun and effective way to learn about nature.	You need to be educated so you can get to where you want to be in life.
Nature	I like to explore nature and see how it works.	It's fun to learn about wetlands and nature.
	Insects are fun.	I do not like learning about insects (bugs)..
	I understand the water cycle and how the wetlands fit into that.	I feel confident talking about how important the wetlands are to the environment.
	It is amazing that wetlands help prevent floods in the city.	The wetlands are really nice and peaceful for kids and adults.

Each of these 86 statements was identified with its theme within the Excel spreadsheet. Excel's ability to sort the table of statements based upon themes was used to further investigate the collection of statements. Within each theme, statements were selected that best represented a range of communications. In other words, statements that were heterogeneous were selected. Additionally, some statements were seen as narrow (Insects are fun) compared to similar statements that were broader (I do not like learning about insects (bugs)). See Table 2 for some examples of statements eliminated and retained.

The resulting Q sample consisted of the following number of statements within each theme: Active (9), Good Student (9), Learning (9), and Nature (13). The statements were then randomly placed into a spreadsheet that had 40 cells for each statement with

an associated number. The random placement ensured that statements were not grouped by theme or by original statement source (e.g. post-presentation, why PBL).

The 40 statements were printed with numbers and cut into individual items. During this next stage, the items were examined to reveal: (1) those statements compatible with goals of the field trip experiences (e.g. acceptance of the important role of wetlands within the larger ecosystems, interest in learning about nature including rocks, insects, animals, and plants), (2) those statements incompatible with those goals (e.g. being in nature makes me nervous, I don't like science). Table 1 displays four main effects and the two levels for the Q sample. The draft Q sample was printed and cut. The items were sorted based on whether they were compatible or incompatible with the goals of the field trip experience. Based on the desired structure shown in Table 3, some of the statements were changed to bring balance between the compatible and incompatible levels. Although there are four more statements in the main effect "Nature," this was deemed acceptable due to the greater stress on nature within the study and project relative to the other three main effects.

Table 3: Q-Sample Structure

Main Effects	**Levels**		**n**
(*A*) Active			9
(B) Good Student	(*a*) compatible	(b) incompatible	9
(C) Learning			9
(D) Nature			13

Once the Q sample was finalized, a sorting grid was created for 40 items with a range of -4 (Most Unlike My View) to +4 (Most Like My View). The final Q sample is provided in Table 4.

Table 4: Q Sample Shown as the Printable Sheet From the Excel Spreadsheet.

1	I am a good writer.	21	I like to feel like a smart kid.
2	I don't have a lot of experience with nature.	22	I love learning about the environment.
3	I want to feel good about my school.	23	I believe it is important to restore the wetlands for future generations.

4	I want to become a creative problem solver.	24	It is good to separate myself from using electronics sometimes and get outside.
5	I really don't like doing problem-based learning (PBL).	25	I like field trips because we aren't at school.
6	There are a lot of things to do out in nature.	26	It's important to be engaged in real-world activities when it comes to science.
7	I like learning about the history of an area like the wetlands.	27	I feel confident talking about how important the wetlands are to the environment.
8	I feel happy when our school is recognized for doing something good.	28	Problem-based learning (PBL) is a good way to get to know people in your class.
9	The wetlands are really nice and peaceful for kids and adults.	29	I enjoy hiking.
10	It makes me feel happy when my friends & I get to support our school.	30	All kids should learn about nature.
11	I feel good when I get to learn stuff I did not know.	31	It is fun to do problem-based learning (PBL) sometimes instead of paper and pencil stuff all the time.
12	I like to learn about animals.	32	I like learning about different kinds of rocks.
13	Walking helps me relieve stress.	33	I enjoy interacting with other students.
14	I like going on trips and seeing new things.	34	I don't really know a lot about nature.
15	I don't know what I want to learn about.	35	I can learn new things about nature better by being in nature instead of just a classroom.
16	I am a good student.	36	I like science.
17	I like to be outside and active.	37	I feel proud of our school.
18	You need to be educated so you can get to where you want to be in life.	38	I am good at being respectful and responsible.

19	I like learning about trees and other plants.	39	Exploring the woods makes me nervous.
20	Everything in nature is beautiful to me.	40	I do not like learning about insects (bugs).

Conclusions

Student responses to prompts as well as student essays provided a rich source of statements for a concourse related to an Urban School series of field trips to a University Field Station. With 186 statements collected for the concourse, a strategic procedure was necessary to create a theoretically-structured Q sample. This procedure consisted of several stages that began with reducing the number of statements based on quality and similarity to other statements and finished with the use of Fisher's experimental design principles. Although the project was related to exposing Urban School to wetlands and a nature preserve to improve these students' interest and knowledge of nature, students' statements collected for the concourse indicated three additional themes related to this experience: Active, Good Student, and Learning. Thus, the students' original writings allowed the researchers to see the other effects of urban school children's exposure to a University Field Station that included the use of project-based learning.

Therefore, the development of the concourse, determination of themes, and selection of the Q sample used here created a better concourse than if the researchers used only the literature or a researcher-created set of statements. In other words, the authors avoided artificially-constructed items for the concourse and Q sample and chose, instead, to have the items constructed from the population's idiomatic expressions a year earlier concerning the same experience of visiting the Nature Center and University Field Station. This is in alignment with Skinner (1953) who stated that behavior is operant because it exists naturally within a particular setting. Similarly, Brown (1980, p 70) described Q as having an "affinity with the logic of naturalistic inquiry (Denzin, 1971)." Thus, no literature review or other means of developing concourse could have replicated the behaviors related to the setting of a high-risk Urban School population of seventh grade inners visiting a University Field Station where some of those children were experiencing a nature center for the first time. This is not to say that all concourses should come from the writings of the same or similar population. However, this study does indicate that Q researchers should be cognizant of language and the uniqueness of their study's setting and participants.

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