A New Approach to Performing Course Evaluations: Using Q Methodology to Better Understand Student Attitudes

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Abstract

In many college classes students are asked to complete course evaluations assessing the performance of their instructor as well as the course structure, learning materials and other relevant aspects of their class in order to assess and improve the course as well as the teaching. However, such evaluations are often limited in their abilities to understand a student's true opinions in terms of what is and isn't successful in a classroom. This paper reports on the use of evaluations based on Q Methodology to rate course elements in four physics and chemistry classes at a two-year college of a Midwestern university. Included are the descriptions of the classes, the presentation of the findings of the evaluations, and a discussion of the issues involved with administering the evaluations to students.

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Introduction

In college courses, student evaluations are conducted to measure the effectiveness and quality of the teaching, the course design, and other learning resources that are implemented in the classroom. These course evaluations are often designed using questions with a Likert Scale. For example, “on a scale of 1 to 5, where 1 means “Poor” and 5 means “Excellent”, rate the effectiveness of the course textbook(s)”. Additional open-ended questions may also be used to solicit specific areas of the learning experience that may not be addressed in the previous questions. Results from the evaluations are then compiled and summary calculations of the quantitative data are made (such as mean, standard deviation, etc.) to provide the teacher and his/her administration with overall scores of the student ratings.

Unfortunately, the aggregation of such numbers eliminates the concept of the student as an individual. If eight out of ten students in a class rate a teacher’s ability to communicate as “Excellent” (5) and the other two provide a rating of “Poor” (1), the average rating would be 4.4 (22/5) which might equate to an overall rating of being “Very Good”. While that number may be acceptable from an administrative standpoint, the presence of the two low ratings should be an area of concern. Why did these students rate the teacher’s communication skills so low? Was the teacher unable to communicate in a language that was understood by the two students? Did those two students perceive a miscommunication, perhaps in terms of instructions or assignments? Were the students mad at the teacher because they received low grades in the class? Without additional input from the students and without each student’s point of view being analyzed as a whole, such questions will not be easily addressed.

Using Q Methodology (Stephenson, 1953) a researcher can gain an understanding of the students as individuals with specific attitudes as well the groupings of the various individual types that

exist within a classroom. In contrast, traditional surveys provide calculated averages that are often generalized across all students in a class. Thus, this research enables improved student input regarding teaching and learning within the classroom and laboratory.

Literature Review

The use of student evaluations as a means to measure faculty performance and course content grew significantly in the latter part of the twentieth century. By 1993 nearly 90% of all college institutions required such evaluations (Seldin, 1993). Many argue that such tools provide objective insight into the evaluation of teaching. Scriven (1994), for example, provides nine sources of validity for the use of student ratings as an appropriate evaluation method:

- the correlation of student ratings with learning gains
- the ability of students to rate their own knowledge gains
- the ability of students to rate the changes in their motivation
- the ability of students to rate observable facts relative to competent teaching
- the ability of students to identify teaching style indicators
- the ability of students to perform simple observations
- the ability of students to report relevant matters of interest
- student ratings represent “democratic decisionmaking”
- the “best available alternative” argument

However, while such measures may be applicable to instruments that have undergone extensive design and refinement, many evaluations are designed by individuals or institutions without the proper measures of validity and reliability. Similarly, as Adams points out (1997, p.11), “when student evaluations of faculty are used summatively to determine retention, promotion, and merit pay, there is the potential for serious consequences in the classroom.” In any case, such evaluations are aimed at providing summative results which do not take in account a student’s entire view towards the learning experience nor do they necessarily measure the importance of the items being measured.

Q Methodology (Stephenson, 1953) represents a process for both examining a person's point of view and identifying similar points of view that exist within a group. Using factor analysis of data collected through a tool called a *Q-sort*, researchers are able to measure an individual's ratings of items relative to each other rather than measuring aggregates of individual, isolated items across a classroom of students. The nature of the Q-sort forces the subject to rate an item in comparison to the other items being evaluated. While this method appears to provide a meaningful tool for the field, the authors were unable to locate any published applications of Q Methodology in the area of student course evaluations.

Subjects / Demographics

The courses evaluated

All of the courses/laboratories evaluated within this study reside within the Department of Engineering and Science Technology of a Community and Technical College that is part of a large, Midwestern, state university. This college grants both associate and bachelor degrees. Evaluations were taken during both the spring semester and an eight-week summer session in 2004. The courses/laboratories within this study were all science courses, either Basic Chemistry or one of four Technical Physics courses.

Each of these courses consists of both a lecture section and a laboratory section. Students do not receive a separate grade for the laboratory section of the course. Instead, students receive one grade for the course. For both Basic Chemistry and Technical Physics courses, 25% of the points received toward the course grade come from the laboratory work. The remaining 75% come from work in the lecture section, including homework, tests, and quizzes.

Basic Chemistry is a required course for associate degree programs in Allied Health, Criminal Justice Technology, and Fire Protection Technology. Often, nursing students, from the College of Nursing, also take Basic Chemistry as preparation for the first chemistry course required for that bachelor degree program. The focus of Basic Chemistry is the learning of inorganic chemistry concepts with minimal mathematical problem solving.

Two sets of Basic Chemistry lecture/laboratory were evaluated during the eight-week summer session. Each set had the same instructor for laboratory and lecture. One of the lecture/laboratory sets met Monday and Wednesday during the day. The other met once a week, Saturdays, for both lecture and laboratory. Each lecture and laboratory had a maximum enrollment of 16 for both the Saturday and Monday-Wednesday sections. Different instructors taught the Saturday and Monday-Wednesday summer Basic Chemistry courses.

Two different Technical Physics courses were also evaluated. The Technical Physics courses are algebra-based and consist of four, consecutive, half-semester (8 week) pairs of lecture and laboratory. These courses only serve the engineering technology programs within the Department of Engineering and Science Technology.

The first of these courses, one of two sections offered of Technical Physics: Mechanics II, was evaluated during spring 2004. The lecture for this course has a maximum enrollment, during spring and fall, of 25 students. Sixteen is the maximum for the associated laboratory. These students had different instructors for laboratory and lecture. Both the lecture and laboratories were taught during the day. The lecture met twice a week. The laboratory sections met once a week for six of the eight weeks of the course.

The second physics course evaluated, Technical Physics: Heat and Light, was evaluated during the eight week summer session, 2004. During the summer, the maximum enrollment for the

laboratory and lecture was 16 students each. These students had the same instructor for both laboratory and lecture. This instructor was not the same instructor that taught either the Technical Physics: Mechanics II laboratories or lecture from spring 2004. Both lecture and laboratory for Heat and Light were offered in the evening. Like Mechanics II, the lecture met twice a week and the laboratory met once a week during the 8 week long.

Specific Student Demographics

Participation in the Q-sort was optional for students and not all students in attendance the day of the administration of the Q-sort participated. Participants were both full and part time and were both male and female. However, in each of the Technical Physics courses there was only one female. The majority of the Basic Chemistry students were female. Due to the nearly homogeneous nature of the genders for these courses and the desire of the Q-sort to be an anonymous survey, participants were not asked to identify their gender.

Methodology

Because the courses being evaluated included both lecture and laboratory components, it was decided that both areas needed to be represented in the evaluation process. Forty statements for the Q-sort were selected from a library of nearly 200 course evaluation items published by the Bureau of Evaluative Studies and Testing of Indiana University (2001). The items selected for the evaluation represented eight statements in each of the following five categories:

- Overall course structure
- Lecture quality
- Lab quality
- Lecture instructor
- Lab instructor quality

Each of the statements is presented in a positive voice. (e.g. “lab sessions were *well organized*”, “the course *increased* my interest in the subject matter”.) The statements (which are listed in Appendix A) were randomly numbered and printed on small pieces of paper for sorting.

All students within the study completed the Q evaluation during one of the final lecture meetings of the course. Completing the evaluation was voluntary and anonymous. Some students chose not to evaluate the courses in which they were enrolled. Other students failed to complete the entire evaluation. Only evaluations that were completed were included in this study.

The same researcher administered all of the Q evaluations for this study. Students received both written and oral instruction (see Appendix B for the form completed by the students) regarding how to perform the Q-sort evaluation. Each student received a packet that consisted of a questionnaire, the 40 pieces of paper with statements, a numerical grid for placing and rearranging the statements, and a numerical grid for entering the final arrangement’s statement numbers.

During the first Q-sort evaluation, in spring 2004, 20 to 30 minutes at the end of the lecture time was dedicated to the evaluation. These same students had completed the college-required teacher evaluation during the previous lecture meeting. Some students reacted negatively to evaluating the same course/instructor twice. In addition, the lecture classroom had no tables. Instead, these students sat at individual chairs with tablets. These tablets restricted the space available for the Q sort. Observations by the evaluation administrator during this first evaluation included student difficulties due to these space limitations. Students became frustrated because both the grid with the statement-pieces and the grid where the statement numbers were to be placed did not both fit on the chair-tablet. Some students became so frustrated after arranging the 40 statements that they did not complete the fill-in grid.

Fortunately, during the summer Q-sort evaluations, students were either already seated at long tables with sufficient space for all of the Q-sort materials or they had similar tables available within the classroom. The availability of sufficient space appeared to decrease student frustration during the Q-sort process. In addition, during the summer, instructors are not evaluated with the college-required, Likert-based instrument. This also seemed to minimize some of the student frustration expressed during the spring-semester 2004 evaluation. During the summer Q-sort evaluation, up to 40 minutes at the end of the lecture time was dedicated to the evaluation. However, nearly every participant in these summer courses completed the Q-sort within 20 minutes or less.

The few students who took more than 20 minutes reported difficulties performing the sort – including the preliminary sort into three piles (agree, neutral, and disagree). In some cases, students expressed their difficulties to the administrator as questions regarding the sort process. In other cases, students expressed their difficulties more as complaints to the administrator. When students had a very positive concept of the instructor, they stated that they had difficulty putting statements in categories other than agree. Some students felt the task took too much time, relative to the college Likert-scale instrument. Some participants also stated that they had difficulty discerning a difference between certain statements. As a specific example, during the sorting process a student complained to the Q administrator that at least some of the Q statements were redundant. She read the following two statements:

34. My instructor makes difficult material easily understandable

28. My instructor explains the material clearly.

In her mind, these two statements were exactly the same. A few other students reported similar complaints to the administrator during or immediately after the sorting process.

Results

Following the administration of the sorts, analysis was conducted using PQMethod. Data was entered and analysis was performed using centroid factor analysis and the manual rotation of factors. Presented in each of the following tables are the factor loadings for each student in each class and the statements that most (and least) characterize the factors as calculated by their Z-scores.

Table 1.
Technical Physics - Evaluation 1

	Factor Loadings		
Evaluations	1	2	3
1	0.3719	0.2048	0.0997
2	0.2457	0.0668	0.5204X
3	0.0013	0.9559X	-0.0329
4	0.3428	0.3043	-0.0896
5	0.4727X	0.2248	-0.1832
6	0.4877X	0.1918	0.2056
7	0.5535X	0.0386	-0.3863
8	0.8290X	0.1916	0.0844
9	0.3149X	0.0260	-0.2403
% expl.Var.	21	13	6

No.	Statement	No.	Z-SCORES
Factor 1: Self-confident			
17	I feel that I performed up to my potential in this course.	17	1.802
18	The total amount of material covered in the course was reaso	18	1.698
10	I kept up with the studying and work for this course.	10	1.417
6	Course assignments helped in learning the subject matter.	6	-1.639
5	Course assignments were interesting and stimulating.	5	-1.763
20	Overall, I would rate the textbook/readings as excellent.	20	-1.912
Factor 2: Negative self			
21	I knew what was expected of me in this course.	21	2.145
15	My instructor adapted to student abilities, needs, and inter	15	1.716
1	I had adequate time to complete lab exercises.	1	1.716
10	I kept up with the studying and work for this course.	10	-1.716
17	I feel that I performed up to my potential in this course.	17	-1.716
11	Lab facilities were adequate.	11	-2.145
Factor 3: Mixed feelings about lab & content			
30	My lab instructor clearly explained the procedures to be use	30	2.145
29	My lab instructor promptly returned reports and assignments.	29	1.716
31	I learned a lot in this course.	31	1.716
14	I was interested in the content of this course before taking	14	-1.716
19	The labs were important to learning in this course.	19	-1.716
13	My lab instructor was prepared for lab lectures and discussi	13	-2.145

Table 2.
Basic Chemistry (weekdays) – Evaluation 2

	Factor Loadings		
Evaluations	1	2	3
1	0.7810X	-0.2394	0.3325
2	0.4703X	0.1917	0.0780
3	0.2884	-0.2943	-0.0957
4	0.1038	0.0912	0.5214X
5	0.4070	0.5233X	-0.2594
6	0.5692X	-0.0245	-0.3399
7	0.4692X	-0.3349	0.0836
8	-0.3499X	-0.0786	0.3212
9	0.6954X	-0.4902	-0.0316
% expl.Var.	25	9	8

No.	Statement	No.	Z-SCORES
Factor 1: Positive view of lecture instructor			
34	My instructor made difficult material easily understandable.	34	2.170
8	My instructor was well prepared for class meetings.	8	1.403
35	My instructor answered questions carefully and completely.	35	1.227
5	Course assignments were interesting and stimulating.	5	-1.673
14	I was interested in the content of this course before taking	14	-1.718
32	Lab assignments were interesting and stimulating.	32	-2.125
Factor 2: Positive view of lab instructor			
7	My lab instructor provided sufficient help in the lab.	7	2.145
1	I had adequate time to complete lab exercises.	1	1.716
13	My lab instructor was prepared for lab lectures and discussi	13	1.716
18	The total amount of material covered in the course was reaso	18	-1.716
14	I was interested in the content of this course before taking	14	-1.716
37	The course improved my understanding of concepts in this fie	37	-2.145
Factor 3: Well prepared for the course but it was not rigorous enough			
14	I was interested in the content of this course before taking	14	2.145
10	I kept up with the studying and work for this course.	10	1.716
19	The labs were important to learning in this course.	19	1.716
17	I feel that I performed up to my potential in this course.	17	-1.716
31	I learned a lot in this course.	31	-1.716
18	The total amount of material covered in the course was reaso	18	-2.145

Table 3.
Basic Chemistry (Saturdays) – Evaluation 3

	Factor Loadings		
Evaluations	1	2	3
1	0.1718	-0.0627	0.4974X
2	-0.0343	0.1172	0.1148
3	0.0048	0.3192	0.6895X
4	0.6831X	0.2150	-0.0145
5	0.3615	0.5877X	-0.1597
6	0.3028	-0.1192	0.4756X
7	0.0048	0.6455X	0.1408
8	0.8766X	0.2399	-0.0502
9	0.2853	0.7446X	-0.0565
10	0.2847	0.1141	-0.2582
11	0.6251X	0.2099	-0.0381
12	-0.0464	0.1142	0.3583X
13	-0.1330	0.1896	0.4545X
% expl.Var.	16	13	11

No.	Statement	No.	Z-SCORES
Factor 1: Positive self / negative instructor			
17	I feel that I performed up to my potential in this course.	17	2.175
10	I kept up with the studying and work for this course.	10	1.709
12	I actively participated in class activities and discussions.	12	1.689
36	This course increased my interest in the subject matter.	36	-1.552
28	My instructor explained the material clearly.	28	-1.630
35	My instructor answered questions carefully and completely.	35	-2.097
Factor 2: Hands-on/ negative instructor			
11	Lab facilities were adequate.	11	1.970
12	I actively participated in class activities and discussions.	12	1.449
1	I had adequate time to complete lab exercises.	1	1.353
35	My instructor answered questions carefully and completely.	35	-1.940
34	My instructor made difficult material easily understandable.	34	-1.988
28	My instructor explained the material clearly.	28	-2.336
Factor 3: Positive instructor / negative course structure			
2	My instructor used teaching methods well suited to the cours	2	1.647
33	My instructor showed genuine interest in students.	33	1.406
8	My instructor was well prepared for class meetings.	8	1.352
32	Lab assignments were interesting and stimulating.	32	-1.866
20	Overall, I would rate the textbook/readings as excellent.	20	-2.008
5	Course assignments were interesting and stimulating.	5	-2.036

Table 4.
Summer Heat and Light – Evaluation 4

	Factor Loadings		
Evaluations	1	2	3
1	-0.0707	-0.4054X	-0.1373
2	0.6646X	0.0164	0.1522
3	0.6470X	-0.3430	0.0119
4	0.3853	0.6209X	-0.1026
5	0.7511X	0.3355	-0.1252
6	0.5358X	-0.2429	-0.0246
7	0.4503	-0.3274	-0.3839
8	0.6258X	-0.1290	-0.2567
9	0.5801X	0.2454	0.2367
10	0.5242X	-0.0636	0.0956
11	0.6849X	0.0194	-0.0606
12	-0.1215	-0.4938	0.5432X
% expl.Var.	30	11	5

No.	Statement	No.	Z-SCORES
Factor 1	**Positive instructor / negative materials**		
29	My lab instructor promptly returned reports and assignments.	29	1.967
34	My instructor made difficult material easily understandable.	34	1.767
2	My instructor used teaching methods well suited to the cours	2	1.374
20	Overall, I would rate the textbook/readings as excellent.	20	-1.641
32	Lab assignments were interesting and stimulating.	32	-1.662
11	Lab facilities were adequate.	11	-2.414
Factor 2	**– Positive self – negative lab & materials**		
31	I learned a lot in this course.	31	1.779
17	I feel that I performed up to my potential in this course.	17	1.765
36	This course increased my interest in the subject matter.	36	1.765
16	Lab sessions were well organized.	16	-1.594
20	Overall, I would rate the textbook/readings as excellent.	20	-1.765
24	My lab instructor related lab exercises to lectures and read	24	-2.121
Factor 3	**- Good overall instruction / negative self**		
8	My instructor was well prepared for class meetings.	8	2.145
21	I knew what was expected of me in this course.	21	1.716
24	My lab instructor related lab exercises to lectures and read	24	1.716
1	I had adequate time to complete lab exercises.	1	-1.716
17	I feel that I performed up to my potential in this course.	17	-1.716
10	I kept up with the studying and work for this course.	10	-2.145

For each class exactly three factors emerged that represented the class population. However, in several cases one student represented a factor. In other cases, students were not associated with any of the factors that were computed.

Recommendations / Future Research

In future implementations of Q-based evaluations, we suggest that a single facilitator continue to be used to administer the evaluations. This enables consistency in the administration of the sorts and the observations of participants. In addition, a sole Q sort administrator, who is not the course instructor, allows the administrator to assist students by reviewing their evaluation in progress without compromising any teacher-student relationship. In addition, a designated administrator is better informed to answer questions that might arise from the students who are likely to be unfamiliar with the Q-sorting process. Unfortunately, because of time constraints and the large number of classes taught at a school, it would not be feasible to conduct such evaluations with the one-to-one interview/interaction between the researcher and subject that is present in many Q studies.

The administration of Q-based evaluations to a larger number of students (20-40 students) in each class would be preferable. As was discovered in our implementation, no more than three factors emerged in any of the classes and several of the factors included only a single student. Larger class sizes (or populations) would likely result in additional, and more stable, better-defined factors.

Finally, the administration of the same Q evaluations throughout a course's semester would enable the researcher and instructor to understand the changes that occur throughout a course. With proper intervention (such as the adjustment of the teaching process) this would also allow the researcher to measure any changes in the course quality from the student's perspective.

The research did include several shortcomings, mostly precipitated by the small class size. Still, the process allows instructors, researchers and administrators to obtain a more complete understanding of their students as individuals compared to is the traditional Likert scale course evaluations. The use of Q methodology provides a new way to perform evaluations and provided additional insight into the points of view that exist within a classroom.

Appendix A

Evaluation Statements

1. I had adequate time to complete lab exercises.
2. My instructor used teaching methods well suited to the course.
3. My instructor organized this course well.
4. My lab instructor was available during office hours.
5. Course assignments were interesting and stimulating.
6. Course assignments helped in learning the subject matter.
7. My lab instructor provided sufficient help in the lab.
8. My instructor was well prepared for class meetings.
9. The objectives for the lab activities were well defined.
10. I kept up with the studying and work for this course.
11. Lab facilities were adequate.
12. I actively participated in class activities and discussions.
13. My lab instructor was prepared for lab lectures and discussions.
14. I was interested in the content of this course before taking it.
15. My instructor adapted to student abilities, needs, and interests.
16. Lab sessions were well organized.
17. I feel that I performed up to my potential in this course.
18 The total amount of material covered in the course was reasonable.
19. The labs were important to learning in this course.
20. Overall, I would rate the textbook/readings as excellent.
21. I knew what was expected of me in this course.
22. My lab instructor provided helpful feedback on lab reports.
23. The amount of lab work required in the course was adequate.
24. My lab instructor related lab exercises to lectures and readings.
25. The objectives of this course were clearly stated.
26. My lab reports were graded fairly.
27. Progression of the course was logical from beginning to end.
28. My instructor explained the material clearly.
29. My lab instructor promptly returned reports and assignments.
30. My lab instructor clearly explained the procedures to be used.
31. I learned a lot in this course.
32. Lab assignments were interesting and stimulating.
33. My instructor showed genuine interest in students.
34. My instructor made difficult material easily understandable.
35. My instructor answered questions carefully and completely.
36. This course increased my interest in the subject matter.
37. The course improved my understanding of concepts in this field.
38. Topics covered in the course were well integrated.
39. Lab assignments were reasonable in length and complexity.
40. I developed the ability to solve actual problems in this field.

Appendix B – Student Course Evaluation Worksheet

The purpose of this evaluation is to better understand the effectiveness of various components of your class and lab (if applicable).

Note: your participation in the evaluation is voluntary and all of your responses will be confidential and your instructor will not see the results of this evaluation until after final grades are submitted.

Instructions

Remove the items from the attached envelope. There will be 40 pieces of paper with statements on them that you will be sorting.

Please read all of the items first. Then, on the sorting page, do an initial sort of the items into one of three intermediate piles corresponding with the right ("Most Agree With"), the left ("Most Disagree With"), and the middle of the grid respectively. This will provide you with smaller groups of items to sort into individual locations on the grid. Each item should eventually be placed under one of the ratings on the grid. The number in parentheses next to the rating is the number of items that should be assigned that rating. e.g. +5(1): 1 item should have a "+5" rating; +4(2): 2 items should have a "+4" rating.

When you have finished sorting the items, copy the number of each of the items to their appropriate location on the Final Ratings grid on the next page. (Each square on the grid should have only one item number.)

Please also answer the following questions:

Age _____

Student Status (circle one)
Full-Time Part-Time

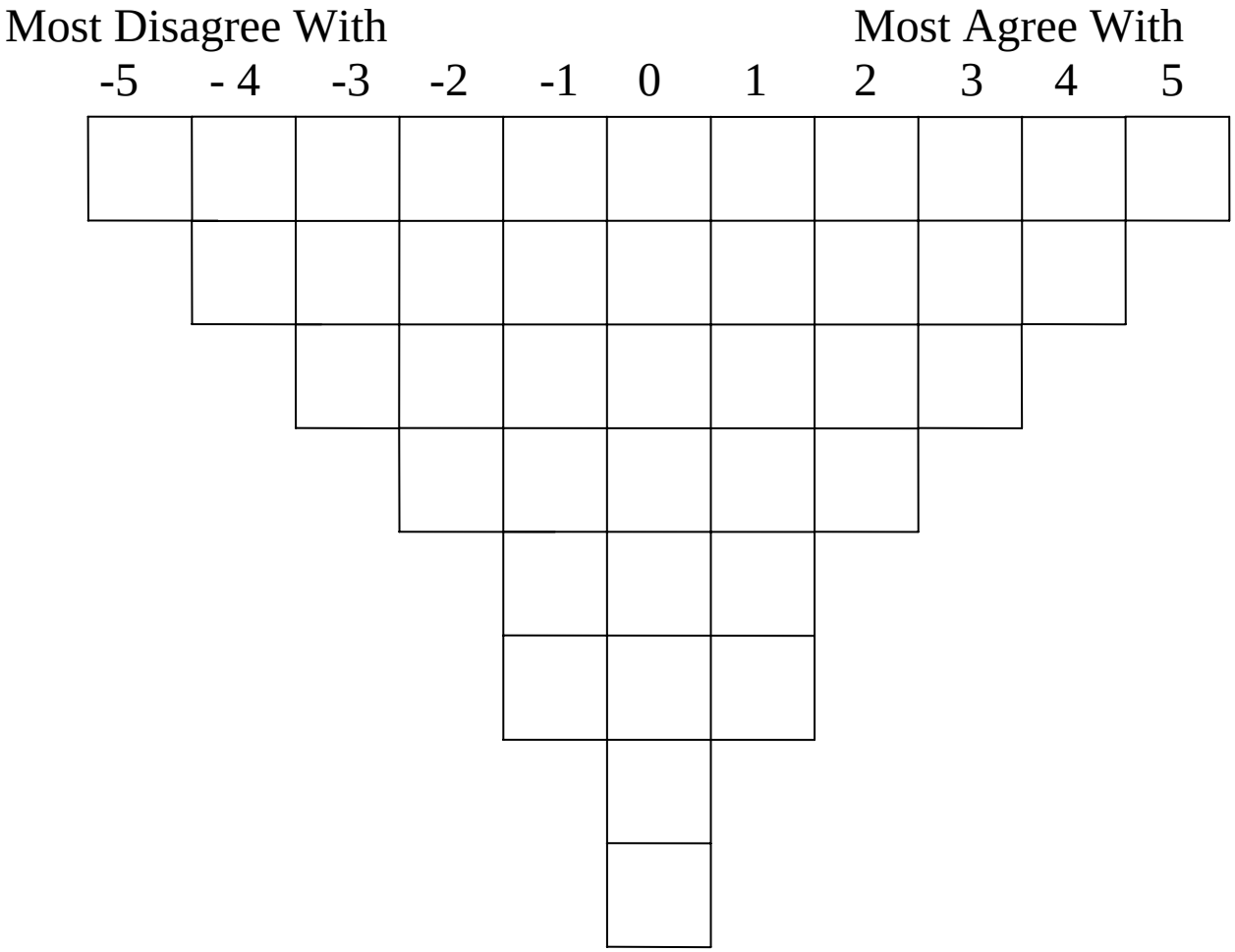
Total number of credit hours taken at University of Akron to date, including this semester (circle one)
0-10 11-20 21-30 31-40 41-50 51-60 61 or more

Grade you expect to receive in this course _____

Number of classes missed for this course (circle one)
0 1-2 3-4 5-6 7 or more

Number of laboratory meetings missed (circle one)
0 1-2 3-4 5-6 (all)

Final Ratings



Why did you choose the item you placed under +5 ? _____

_____

Why did you choose the item you placed under -5 ? _____

_____

Any other comments about your evaluation ? _____

_____

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