

Using Identity Indicators to Describe Graduate Students' Views of Statistics Courses in the Context of Major-Specific Courses

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Abstract: *The purpose of this study was to explore the differences in descriptions of self for graduate students in a College of Education while taking courses in their major and while taking required statistics courses. Q methodology was used to highlight differences in these two descriptions for 26 participants sorting the same 36 statements related to identity twice, first as a student in a course related to their major and second as a student in a statistics course. These data were correlated and factor analyzed to reveal two distinct views. Interpretation resulted in characterizing the two views as Confident and In Control, and Anxious and Alienated. Graduate students generally feel in control in their major and more fearful studying statistics, but this was not true for all students. Results are discussed in terms of the implications for managing negative feelings toward statistics as a challenge to identity.*

Statistics anxiety poses a threat to earning graduate degrees when statistics courses are required for graduate programs in the social, behavioral and educational sciences. It is well documented that many students at all educational levels hold negative views of statistics, experience statistics anxiety, and may therefore struggle with academic performance (Onwuegbuzie, 2000; Onwuegbuzie & Wilson, 2003; Zeidner, 1991). Statistics anxiety is pervasive, with 67 to 80% of graduate students experiencing some anxiety toward statistics (Onwuegbuzie & Wilson, 2003). As the need for statistical literacy continues to increase (Garfield & Ben-Zvi, 2007), a better understanding of the relationship of identity as related to anxiety may assist in addressing this problem.

Statistics anxiety is defined as, "a performance characterized by extensive worry, intrusive thoughts, mental disorganization, tension, and physiological arousal. . . when exposed to statistics content, problems, instructional situations, or evaluative contexts" (Zeidner, 1991, p. 319). Factors found to be associated with statistics anxiety

include prior poor performance in math (Baloğlu, 2003); attitudes toward and perceptions of statistics (Garfield & Ben-Zvi, 2007; Zeidner, 1991); learning styles (Onwuegbuzie, 1998); the nature of statistics courses, such as content, terminology, and instructors (Baloğlu, 2003); and apprehension toward assessment (Zeidner, 1991). While these studies provide valuable insight into cognitive triggers of anxiety, limited research has been done on the influence of intrapersonal factors, such as perceptions of self, on statistics anxiety. In a multivariate study of the relationship between self-perception and statistics anxiety among graduate students in a College of Education, perceived self-worth emerged as a possible suppressor variable in the prediction of statistics anxiety (Onwuegbuzie, 2000). A suppressor variable reduces, or suppresses, variation due to error in the predictor variable because of its correlation with the predictor (Pedhazur, 1997). A suppressor variable may not be a significant predictor itself, but it adds to the predictive power of another variable. When suppression variables are interpreted in light of theory, they may be meaningful in understanding the phenomenon under study.

It is clear that self-worth is important for understanding the relationship between self-perception and anxiety (Covington, 1984, 1992). Self-worth theory, which is associated with motivation and academic goal orientations, posits that some students are motivated by a desire to maintain an image of competency, or a performance-approach orientation, while other students may be motivated by a desire to avoid an image of incompetency, or a performance-avoidance orientation (Anderman & Wolters, 2006). Dweck, Chiu, and Hong (1995) maintain that views of self as either fixed and unchanging (entity view of self) or fluid and malleable (incremental view of self) influence how individuals react to experiences that challenge one's self perception. Students who hold an entity view of self may react to academic challenges, such as statistics courses, by attempting to avoid difficult work, while students with an incremental view of self may embrace challenges and accept that difficult material is not a reflection of who they are as a student, but rather presents an opportunity to grow in new directions. The overall goal of performing well is most salient when the need for achievement is high (Roeser, Peck, & Suad Nasir, 2006), such as in a graduate program. However, a high need for achievement may be met by an avoidance reaction that is maladaptive to achievement.

Theoretical Framework

Q methodology was used for this study, with a theoretical framework to guide the development of the instrument. Indicators of identity-processing styles, or markers of how one processes and reacts to challenges to their identity, were used as statements in the sorting

procedure to assist in contrasting self in a secure course (major-specific course such Principles of Counseling) as opposed to self in a statistics course. Identity development occurs throughout one's lifetime and in response to environmental and social factors as well as to self-perception (Erikson, 1960). This makes identity crises, when one's sense of self is challenged, possible at any stage of life. Feelings of anxiety may result if the challenge is avoided, or a revised and perhaps more realistic perception of self may emerge as the challenge is confronted. Identity is multifaceted, with identities shifting to accommodate different roles that individuals occupy at a given time and in a given situation. The concept of role identity asserts that individuals engage in multiple roles, and that identity may be negotiated to adapt to these roles. These role identities are then legitimized by role performance (Jazvac-Martek, 2009). When students react to academic subjects with a performance-avoidance approach, the roles they are accustomed to performing, such as that of student with a history of achievement, no longer seem possible. They begin to reconstruct, or reprocess, their self-identity, or theory of self, using identity processing styles (Berzonsky & Kuk, 2005; Whitbourne, Sneed, & Skultety, 2002).

Identity processing styles consist of the cognitive strategies individuals use to negotiate their identity across contexts (Was, Al-Harthi, Stack-Oden, & Isaacson, 2009). Research suggests these processing styles influence academic achievement (Berzonsky & Kuk, 2000). If this is the case, then educators and educational researchers must consider the effect of identity processing on the formation and maintenance of anxiety. Berzonsky and Kuk (2005) proposed three orientations to identity processing styles: informational, in which new information is used to reconcile challenges to identity via self-reflection; normative, which relies on the expectations and beliefs of significant others; and diffuse/avoidant, in which personal conflicts are avoided. In the identity processing model proposed by Whitbourne et al. (2002), a balanced style is reflective of a performance-approach orientation in which challenges are met with a reflective, problem-solving reaction; the assimilation style allows behavior to be dictated by the immediate situation; and the accommodation style negotiates identity in terms of the expectations of others. Although one may typically rely on a particular processing style, certain situations may present a greater threat to self-concept than others.

Purpose of the Study

The purpose of the current study was to describe how non-statistics graduate students in a College of Education perceive their identity in courses related to their major and in statistics courses, using Q methodology as a research strategy. Q methodology is an effective

approach for studying beliefs, or subjective viewpoints, of individuals since it is oriented toward participants' impressions rather than expressions (McKeown & Thomas, 1988). Impressions emerge from an intraindividual frame of reference, which allows participants to sort Q statements according to their own perceptions (Brown, 1980).

Although the existence of statistics anxiety and its effects on performance are well documented, the use of Q methodology offers a more holistic understanding of the phenomenon of statistics anxiety through the perspectives of individual students and their perceptions of self in situation-specific contexts. As Onwuegbuzie (2000) argues, "perhaps no other field of study poses as much threat to self-concept as does statistics" (p. 325). Accordingly, the specific research question is: How does perceived identity of non-statistics graduate students in a College of Education vary between courses specific to their major and required statistics courses?

Method

Previous research on both academic identity and statistics anxiety has been conducted using surveys with multiple choice responses, such as Likert-scale items (Was et al., 2009), and, to a lesser extent, qualitative interviews (Onwuegbuzie, DaRos, & Ryan, 1997). While qualitative methods provide rich description of a few individuals' viewpoints, this approach is limited by the time and expense involved in in-depth interviews. Research using scales aggregates findings based on mean scores and fails to reveal subtle nuances of intraindividual perceptions. Applying Q methodology to the study of identity and statistics anxiety contributes to understanding the relative strength of identity processing styles in terms of understanding their relation to statistics anxiety.

The study was designed to comply with the ethical standards that guide human subjects research and received Institutional Review Board approval. The participants consisted of 26 graduate students taking statistics courses in a College of Education at a mid-sized university in the south-central United States. Participants were non-statistics majors and were required to take statistics courses as part of their degree programs. These programs were primarily educational psychology and community or school counseling. Participants were recruited through presentations by the researcher in introductory statistics, ANOVA, and multiple regression courses and through contacting former students the researcher had tutored in these courses. The latter approach was used to recruit participants thought by the researcher to dislike or be anxious about statistics. This purposive approach is in line with the Q tradition to select participants based on characteristics of interest in the study (Brown, 1980).

Participants' ages ranged from 24 to 54 (mean age was 40); eight participants were seeking Master's degrees and 18 were doctoral students. The number of statistics courses taken ranged from one to 10, with 18 participants reporting from one to three courses. Thirteen participants reported average statistics grades of A, and another 13 reported B grades. As a frame of reference, the researcher, although currently pursuing a degree in educational research with an emphasis in statistics, participated in the study by sorting from her former perspective as a sociology graduate student fearful of statistics.

The concourse was sampled from the identity processing style Q sort (Pittman, Kerpelman, Lamke, & Sollie, 2009), the identity and experiences scale (Whitbourne et al., 2002), the academic identity measure (Was & Isaacson, 2008), and research conducted using the identity strategies inventory (Berzonsky & Kuk, 2000, 2005). All of these instruments relied on the concept of identity processing styles, with Whitbourne et al. (2002) and Pittman et al. (2009) listing items by category of processing style. The concourse was further expanded with statements from previous conversations with statistics students during tutoring sessions; "minute papers" in which students briefly recorded their reactions to the course, collected in one section of an introductory statistics course taught by the researcher; and the researcher's personal experience taking statistics courses.

For the present study, statements were selected as much as possible to represent the three identity processing styles proposed by Berzonsky and Kuk (2000) and Whitbourne et al. (2002) and common statements heard by students who struggle with statistics courses. The wording of statements gleaned from other instruments was modified to better represent the purpose of the present study. For example, this statement from the identity and experiences scale (Whitbourne et al., 2002), "I try not to get into situations that cause me to question myself" was modified to read "I am quick to abandon activities that make me doubt my abilities." Similarly, the statement from the academic identity measure (Was & Isaacson, 2008), "Sometimes I get upset when I do poorly on a test and other times I just let it slide" was adapted to "If I do poorly on a test, I get upset and feel that I must not be capable."

Statements were assigned by the researcher to the identity processing style that best explained the statement or that had been previously identified in the literature as representing a particular style (Pittman et al., 2009; Whitbourne et al., 2002). The final Q set consisted of 12 items thought to reflect an informational/balanced identity style, 10 representing a normative/accommodation style, and 14 reflecting a diffuse-avoidant/assimilation style, for a total of 36 statements. The Q set used for this study can be found in the Appendix.

The 26 participants were asked to perform two sorts, from most unlike me (-4) to most like me (+4), first in response to the question, "Thinking about your favorite course in your major, what kind of student were you, or, if currently taking this class, what kind of student are you?" and the second in response to the question, "Thinking about a statistics course you have taken for your graduate degree, what kind of student were you, or, if currently taking this class, what kind of student are you?" As a result, there were 52 total sorts. After completing the two sorts, participants were asked to complete a survey of demographic information, which included an open-ended question asking participants to provide additional thoughts about the statements they sorted.

Results

The data were analyzed using PQMethod 2.20. A principal components analysis was performed on the correlation matrix followed by varimax rotation. Examination of two-factor and three-factor extractions resulted in the two-factor solution retained based on the number of sorts that could be used to explain the rotated factors. The final solution contained 37 sorts on the first factor array, accounting for 40 percent of the variance, and 14 sorts on the second factor array, accounting for 16 percent of the variance. The remaining sort was confounded as it loaded moderately but non-significantly on both factors.

Factor interpretation was aided by analysis of both student comments on the demographic survey and field data of comments provided after completing sorts. The correlation of the two factors was $-.04$, suggesting that the factors represent two distinct views of self in relation to course type. There are those who see themselves as confident and in control of their learning, and there are those who feel anxious and alienated from the course.

Factor 1: Confident and In Control

The most salient aspects of this viewpoint are that, being in graduate school, these students have set academic goals (statement number 1; array position -3) and are motivated to achieve them (18; +4). They feel in control of their learning (2; -4), and are confident in their abilities to succeed as graduate students (5; -3). In the context of which sorting was done (major or statistics course), this perspective does not often feel lost in class (9; -3), which likely contributes to a frequent sense of competence (22; +3). In response to high course demands their first reaction is to work harder (21; +3). This may depend, however, on whether they perceive the course as contributing toward their professional goals (24; +4) and whether they are comfortable in the course and feel they belong (31; +3). Positive perceptions of the course itself and of themselves as members of the course are important for these students, for whom doing well in school is one of their most

important priorities (20; +3). For this perspective, giving up on school is not an option (14; -4). In summary, Confident and In Control students see themselves as adept and capable of meeting personal and professional goals and respond favorably to courses that reinforce this self-perception. Because they are willing to embrace experiences that might challenge how they see themselves (6; -3), they are open to being challenged in courses they feel are relevant to and necessary for meeting their goals and consist of others with shared career goals. The following responses to the open-ended survey item and informal verbal statements exemplify the Confident and In Control perspective.

I started [statistics course] hesitant, but now I'm more confident.

I just keep working through [the material] and getting help.

I feel that my performance for my most enjoyable class is equal to my performance for my stat courses. However, my stat courses are more difficult and require more work.

Perhaps not surprisingly, all 26 students saw themselves as Confident and In Control when sorting according to the first condition of instruction, as a student in a course specific to a their major. However, 11 of these students also saw themselves as Confident and In Control when sorting for the second condition of instruction, as a student in a required statistics course. This group consisted of eight females and three males, aged 24 to 54, with three pursuing Master's and eight pursuing doctoral degrees. Eight reported an average statistics course grade of A, and three reported average grades of B.

Factor 2: Anxious and Alienated

The sorts of 14 students, completed according to the second condition of instruction, as a student in a statistics course, loaded significantly on this factor. The most salient aspects of this viewpoint are that, in a statistics course, students with this perspective often find themselves lost in class (9; +4), reacting to material they do not understand by becoming anxious (8; +4) and letting their mind wander (7; +3). Doing poorly on a statistics test is upsetting as they see it as a threat to their perception of themselves as capable students (3; +3). While this perspective is willing to consider information that is inconsistent with their beliefs rather than disregarding it (30; -3), this may actually work against them if it contributes to a shift from believing themselves capable students in a course related to their major to believing themselves incompetent in a statistics course (22; -3). They are willing to ask others for help (12; -3), but this willingness may be mitigated due to feelings of being uncomfortable in the course and a sense that they do not belong (31; -3). In summary, the Anxious and Alienated student finds no enjoyment in a statistics course (26; -4) and perceives oneself as alienated from both the content (15; -4) and the course itself. This is of concern given

that this perspective, like the Confident and In Control viewpoint, places a high priority on doing well in school (20; +3). Having friends in the same class is extremely important for this perspective (35; +3).

Although the sorts for the Anxious and Alienated perspective share a lack of salience with the Confident and In Control viewpoint regarding an emphasis on maintaining a 4.0 to the exclusion of learning more challenging material (13; array position -1 for both), this theme emerged for the Anxious and Alienated student in responses to the open-ended survey item and informal post-sort comments, as exemplified by the following quotes.

I am in my last semester [of graduate school] and have a 4.0 in my major. Statistics is very challenging for me. . . . I am often confused by the concepts. I worry about getting a B or C in this course.

I just want to keep my 4.0.

I hate statistics. All I care about is getting an A.

Moreover, moderately salient for this viewpoint is the belief that statistics courses are not leading them toward their professional goals (24; -2), as demonstrated by this quote, "I don't know why I have to take [statistics] classes." This is important given the high salience of this item for the Confident and In Control perspective (array position +4).

This group of 14 students consisted of 12 females and two males, aged 26 to 52, with five pursuing Master's and nine pursuing doctoral degrees, 10 who reported an average statistics grade of B, and four who reported an average grade of A.

Discussion

Despite the lack of correlation (-.04) between the two factors, the two perspectives share some points of consensus. The most salient shared perspective, as noted above, is that good performance in school is among their top priorities (20; array position +3 for both). Moderately salient to both perspectives is that engaging in self-reflection is not resisted (11; -2), and they are unlikely to immediately disregard information that is inconsistent with their beliefs (30), although this statement emerged as more salient for Anxious and Alienated (-3) than for Confident and In Control (-2).

For at least some aspects of their graduate education, the students who participated in this study see themselves as good students whose abilities to complete their programs are virtually unquestioned. However, some students react to a statistics course very differently than they do to a course for their major, which has implications for how they see themselves as students, and ultimately, for course performance. Many of the most salient items for the Anxious and Alienated perspective reflect a diffuse/avoidant approach to dealing

with challenges to identity. This approach is reactive in nature and results in feelings of self-doubt when the challenge cannot be avoided (Berzonsky & Kuk, 2000). Their status as 4.0 students is suddenly in jeopardy, and as demonstrated by the above quotes, this is of extreme concern for these students. The Anxious and Alienated viewpoint also appears to represent, to a lesser extent, a normative/accommodation approach to identity challenges that could prove beneficial for these students. This approach looks for affirmation and acceptance from others in the face of an identity challenge (Berzonsky & Kuk, 2000; Whitbourne et al., 2002). Some of the anxiety and feelings of alienation they experience might be ameliorated if friends are in the same class. As one Anxious and Alienated student commented, "I don't know what I'd do without my friends in there [statistics course] with me."

Perhaps of greatest interest are those students who see themselves as Confident and In Control in both types of courses. There is much in this viewpoint that reflects an informational/balanced approach to negotiating challenges to identity. Using new information and problem solving to approach challenges to self-concept (Berzonsky & Kuk, 2000; Whitbourne et al., 2002), aspects of this perspective could be important to helping the Anxious and Alienated student become more comfortable, or at least less afraid of the material, in a statistics course.

The purpose of the present study was to use Q methodology to explore how non-statistics graduate students in a College of Education at a mid-sized research university perceive themselves in courses specific to their major compared to required statistics courses. This study is not meant to imply that students in majors other than those specifically related to statistics do not value statistics. Instead, the implication of the current study is that statistics educators need to understand not only how students view statistics, but also how they view themselves as statistics students. The two theoretical arrays that emerged from this study reflect implicit theories of self. The incremental self is adaptable and able to confront change because of this adaptability. This is similar to the Confident and In Control viewpoint, in which an individual uses new information to reconcile challenges. Those with a static view of attributes avoid challenges because of the threat to how they perceive themselves. This is similar to the Anxious and Alienated perspective in which one avoids conflicts as a means of maintaining their sense of self.

The results of the present study suggest that Anxious and Alienated students experience psychological distress in reaction to statistics courses, which impedes their ability to reconcile challenges to their academic identity from a more balanced and informed perspective. Although these students may believe themselves likely to seek help for a difficult course, actively seeking help may be hindered by a desire to avoid being perceived by others as a poor student. For those with a more

avoidant tendency, an internal sense of cognitive dissonance forms when experiencing a situation that challenges their long-held perception of themselves, and efforts are made to hide this dissonance from others (Onwuegbuzie, 1999). On the other hand, Confident and In Control students appear to possess a more balanced approach to identity development, which means they may be more likely to seek help and to accept the challenges of statistics courses, despite how difficult it may be for them or how they may be perceived by others.

As anxiety and identity are complex constructs demonstrated to be theoretically related, research into statistics anxiety should explore the non-cognitive factors that contribute to its formation and maintenance. The purpose of this study was not to understand how students view statistics, but how they view themselves while taking statistics courses and how this perception might change according to situation. The analysis conducted for this study adequately answered the research question, "How does perceived identity of non-statistics graduate students in a College of Education vary between courses specific to their major and required statistics courses?" The use of two conditions of instruction allowed for insight into how student self-perceptions vary by course and revealed that, at least for some students, perceived academic identity does not vary regardless of course, while for others it varies extensively.

While there is little more than can be explained from the present data, perhaps the most important findings are that not all graduate students in educational programs react the same way to statistics courses. There are important aspects of the Confident and In Control perspective, many supported by the literature on best practices to reduce statistics anxiety, which have implications for statistics education. For example, for a student to feel Confident and In Control, they must perceive the course as leading them toward professional goals. This suggests that statistics educators could do more to connect content to students' experiences and relate it to their careers, which may increase their motivation to learn course material (Freeman, Collier, Staniforth, & Smith, 2008). Moreover, giving students, particularly those feeling anxious and alienated, an opportunity to be successful, no matter how elementary the task may seem to the instructor, is an important step toward fostering a sense of competence among students (Metje, Frank, & Croft, 2007). For this to occur, however, statistics instructors should strive to create a sense of community in the course and ensure that all students feel some sense of belonging (Macheski, Lowney, Buhrmann, & Bush, 2008). With these aspects in place, the Anxious and Alienated student may be less likely to respond to statistics with anxiety and instead work through the emotional reactions by devoting themselves to the material. Part of the challenge of working with

students fearful of statistics is moving them past psychological barriers, such as the firm belief they are incapable, that students create for themselves (Onwuegbuzie & Daley, 1999).

This study is not without its limitations, one of which is the Q set. Research on academic identity and its relation to anxiety is expanding, which may require statement modification or the addition of new statements to effectively capture the identity concourse. Additional Q studies may use the same or similar conditions of instruction with a modified Q set to further investigate the role that cognitive dissonance plays in statistics anxiety. Since this study suggests that distinct views of self-concept exist according to course, additional demographic variables, such as time between degrees, survey items specific to attitudes toward statistics and perceived identity, and in-depth interviews of participants whose sorts are highly correlated with a particular viewpoint are needed. Additional viewpoints may be captured by recruiting students in statistics courses taught by instructors from outside the College of Education, and by using a larger distribution continuum (e.g., -5 to +5) with additional statements. Despite these limitations, this study adds a new approach to the study of statistics anxiety that suggests identity, and how one reacts to challenges to identity, is an important factor for educators to consider when working with graduate students fearful of statistics.

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Appendix: Q Sample and Factor Scores

	<i>Statements</i>	<i>1</i>	<i>2</i>
1	I rarely set academic goals for myself.	-3	-1
2	My learning is out of my hands.	-4	-2
3	If I do poorly on a test, I get upset and feel that I must not be capable.	-1	+3
4	I rarely think about “who” I am as a student.	-1	0
5	I often doubt my abilities to succeed in graduate school.	-3	+2
6	I avoid experiences that might challenge how I see myself.	-3	0
7	In class, my mind often wanders and I wish I was someplace else.	0	+3
8	I get anxious when I don’t understand something.	0	+4

<i>Statements</i>		<i>1</i>	<i>2</i>
9	Often I feel lost in class, like I don't know what's going on.	-3	+4
10	I am quick to abandon activities that make me doubt my abilities.	-2	+1
11	I am not interested in self-reflection. I am who I am.	-2	-2
12	I resist asking others for help.	-1	-3
13	Keeping a 4.0 is more important than learning challenging material.	-1	-1
14	Sometimes I feel like giving up on school.	-4	0
15	A's come easy to me because I'm comfortable with the content.	+1	-4
16	I keep a positive attitude when it comes to learning something that doesn't come easily.	+2	+1
17	I like making mistakes because I learn so much more.	0	-1
18	Most days I am motivated to learn.	+4	+1
19	I find most class topics interesting.	+2	-1
20	Although I have many priorities, doing well in school is one of the most important.	+3	+3
21	When this course is demanding my first reaction is to work harder.	+3	+2
22	Most of the time, I feel competent.	+3	-3
23	I feel confident in "who" I am as a student.	+2	0
24	I feel like this class is leading me toward my professional goals.	+4	-2
25	I am open to changing my idea of who I am or what I could become based on new experiences.	+1	+2
26	This class is a lot of fun for me.	+2	-4
27	I mostly base my decisions on what significant others think I should do.	-2	-2
28	I often turn to professors or close friends for advice about school.	+1	+2
29	Being in graduate school means I've made a decision about myself that I'm not open to changing.	0	-1
30	I disregard information that is inconsistent with my beliefs	-2	-3
31	I am comfortable in this class and feel that I belong.	+3	-3

Statements		1	2
32	If I am struggling, I worry what my friends and family will think.	0	0
33	I'll get embarrassed if other professors find out I did poorly in this class.	+1	+1
34	In large part, how well I do in my classes defines who I am.	+1	0
35	I am okay in difficult classes as long as I have friends in the same class.	0	+3
36	There is nothing worse than not knowing anyone else in a class.	-1	+1