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THEME

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MSBM   The University of the West Indies, Mona

Predicting Performance in Quantitative Research at the University of the West Indies: A Case of Self Assessed Competences vs. Actual Grades

Trevor Smith, January 8, 2015

Background to Problem

The need for quantitative skills

- Countries and their industries have embraced quantitative methods as the business and econometric tool for analyzing business problems

- The decline in productivity in countries such as the United States has been associated with declining skills among students in mathematics and sciences

- There has been 'talk' that quantitative skills are rapidly declining among students in the West and that this decline could be indicative of the struggling economies of the western world.

More Problems

Comparative study of Social Science and Education students, from Finland and USA, Murtonen (2005) found a **negative orientation towards quantitative methods** among students from both countries.

Students were either:

- Experiencing difficulties in learning quantitative methods
- Lacking appreciation for empirical work.

Many university students continue to suffer from:

- Statistical anxiety (an aversion the student encounters when faced with statistics)
- A general inhibition to pursue quantitative research

(Baloglu et al., 2011; Bradstreet, 1996; Kennett et al., 2009)

The Problem continues at the graduate levels

- **Statistical anxiety is experienced by approximately 80% of graduate students**; and is found to have a debilitating effect on performance in both statistics and research methods courses (Onwuegbuzie, 2004).

- **70% of graduate students do not read the 'Methods' section** when assigned quantitative articles because they find the material complex; and do not understand how methods are linked to the hypotheses being tested (Corner, 2002, p. 671).

The Gap

- Quantitative methods as well as the science of learning research in general have not been extensively studied despite the difficulties that students experience in this area (Murtonen et al., 2008).

Addressing The Gap

- **Research Questions**
  - **1a**: What are the factors that will improve students' proficiency in quantitative research among university students?
  - **1b:** How will these factors impact students' self-determination of proficiency vis-à-vis proficiency determined by actual grades

Theoretical Foundation

Knox's Proficiency Theory of Adult Learning

- Proficiency is the unifying concept for relating **knowledge**, **skills** and **attitude** to improve **performance** of the adult learner (Knox, 1980).

- If the student has acquired the knowledge, gained the skills and displays the right attitude towards the subject matter, then he or she will perform 'satisfactorily', ceteris paribus

Theoretical Foundation

Self Determination Theory

- SDT focuses on the degree to which an individual's behavior is self-motivated and self-determined(Deci & Ryan, 1980)

- SDT concerns with the motivation behind the choices that people make without any external influence and interference.

Factors that could influence Proficiency

- The review of the contemporary literature in this research has led to six separate factors that could influence proficiency in quantitative research. These are:

  1. ***Student motivation*** (Breen & Lindsay, 1999)

  2. ***Competence with statistical software*** (Proctor, 2002)

  3. ***Quantitative aptitude*** (Schuhmann et al., 2005)

  4. ***Aptitude for data analysis*** (Onwuegbuzie, 2000)

  5. ***Understanding statistics*** (Corner, 2002; Murtonen, 2005)

  6. ***Teacher's influence*** (Knox, 1988)

Research Model and Hypotheses

Student Motivation and Proficiency in Quantitative Research

- It was found that students who considered proficiency in research as important to the world of work {**proficiency**} had a deeper approach to learning {**motivation**}and found it easier to learn research methods than other students (Murtonen et al., 2008).

- Thus, it is proposed that:

  ➢ **H1:** Student motivation is positively associated with proficiency in quantitative research

Research Model and Hypotheses

Competence with Statistical Software and Proficiency in Quantitative Research

- Competence with statistical software was found to be a positive indicator of performance in quantitative research (Proctor, 2002).

- In his study of Excel and SPSS users, Proctor (2002) found that:
   1. Students randomly assigned to use Excel for statistical analysis reported higher levels of proficiency in quantitative methods than those randomly assigned to use SPSS.
   2. Excel users had a better understanding of, and competence with, the software than SPSS users.

Hence, it is proposed that:

➢ **H2:** Competence with statistical software is positively associated with proficiency in quantitative research

Research Model and Hypotheses

Quantitative Aptitude and Proficiency in Quantitative Research

– Quantitative aptitude was found to be a very important determinant of performance in economics on both pre and post course surveys (Schuhmann et al., 2005).

Hence, it is proposed that:

➢ **H3**: Quantitative aptitude is positively associated with proficiency in quantitative research

Research Model and Hypotheses

Aptitude for Data Analysis and Proficiency in Quantitative Research

– Aptitude for data analysis and understanding of measurements are highly correlated; Also,

– Understanding of measurement will deepen the student's capacity and improve his/her performance in quantitative research; thus implying a positive relationship between aptitude for data analysis and proficiency in quantitative research (Corner, 2002).

Hence, it is proposed that:

➢ **H4:** Aptitude for data analysis is positively associated with proficiency in quantitative research
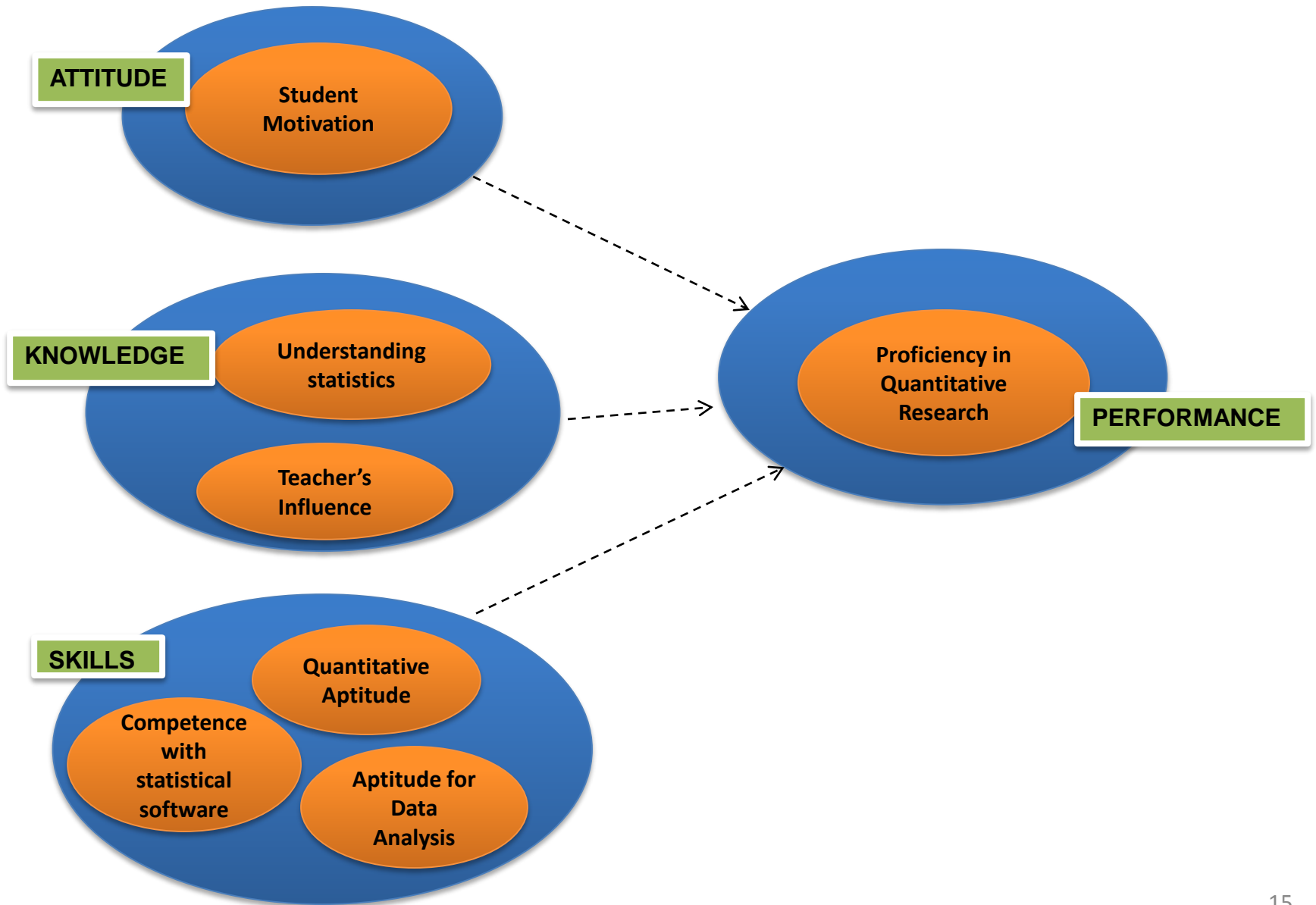
Research Model and Hypotheses

Understanding Statistics, Teacher's Influence & Proficiency in Quantitative Research

– Bad teaching is negatively associated with competence in quantitative research as the large majority of students are already saddle with statistical anxiety and negative attitudes to research (Corner, 2002; Murtonen, 2005).

– understanding of statistics is a well establish precursor to performance in quantitative research (Bell, 2003).

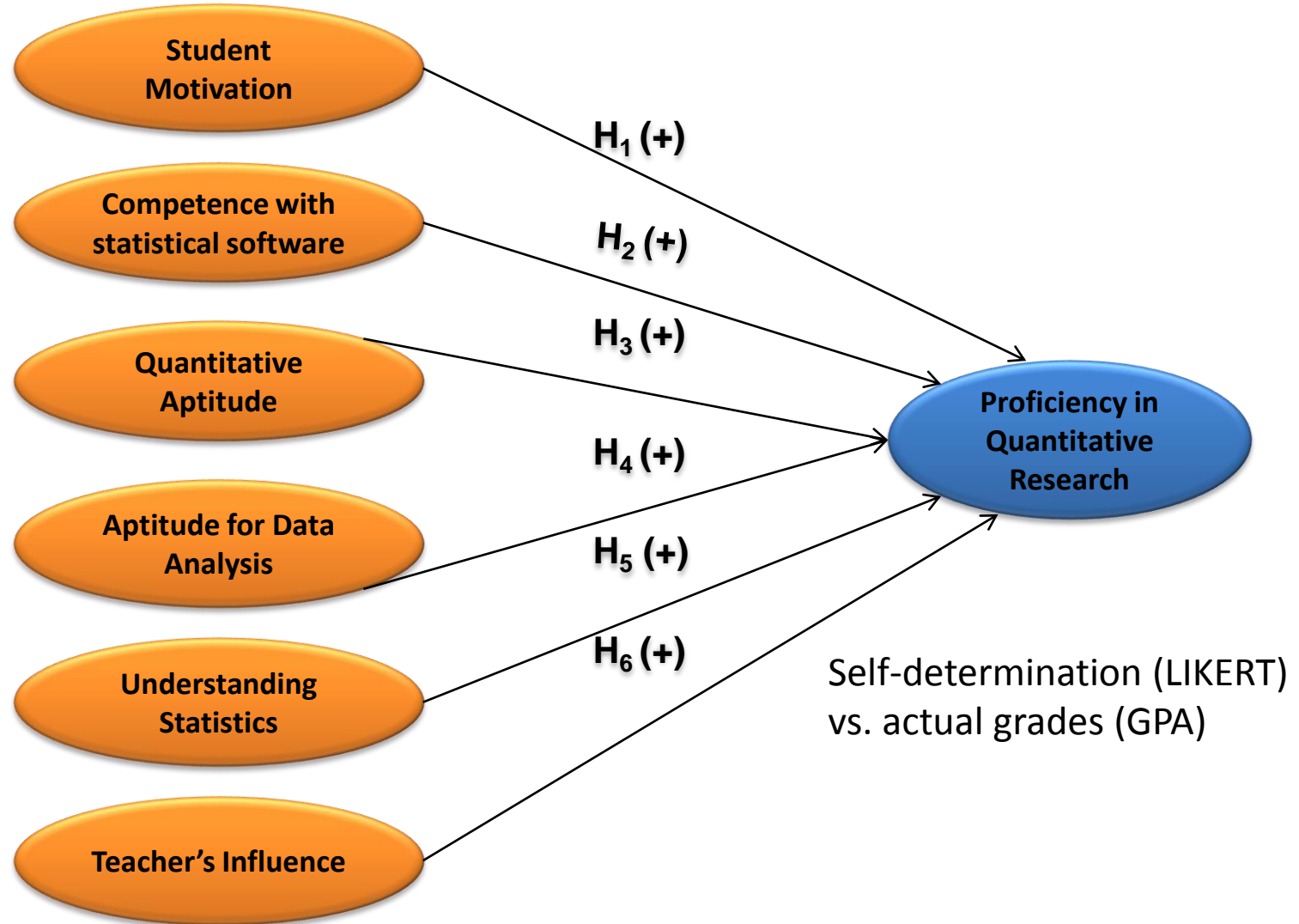Taken together, It is therefore proposed that:

➤ **H5:** Understanding statistics is positively associated with proficiency in quantitative research

➤ **H6:** Teacher's influence is positively associated with proficiency in quantitative research

Operationalizing Knox's Theory

ATTITUDE
- Student Motivation

KNOWLEDGE
- Understanding statistics
- Teacher's Influence

SKILLS
- Quantitative Aptitude
- Competence with statistical software
- Aptitude for Data Analysis

PERFORMANCE
- Proficiency in Quantitative Research

Research Model and Hypotheses

Student Motivation → H_1 (+) → Proficiency in Quantitative Research

Competence with statistical software → H_2 (+)

Quantitative Aptitude → H_3 (+)

Aptitude for Data Analysis → H_4 (+)

Understanding Statistics → H_5 (+)

Teacher's Influence → H_6 (+)

Self-determination (LIKERT) vs. actual grades (GPA)

Methodology

Sample Items
5 point Likert scales (strongly disagree …. strongly agree)

- **Understanding Statistics** (8 items); Alpha = .895

  'I have a good understanding of statistical tests',
  'I have a good understanding of *p* values' and
  'I have a good understanding of the concept of confidence intervals'

- **Competence with Statistical Software** (2 items); Alpha = .847

  'I am hands-on with at least one statistical software (e.g. SPSS, EXCEL, SAS, MINITAB)'
  'I am able to effectively apply the software to research hypotheses'

- **Student Motivation with Quantitative Research** (4 items); Alpha = .610

  'I am motivated by quantitative research',
  'I believe quantitative research is very important to my future career', '
  'I do not enjoy quantitative research'

- **Quantitative Aptitude** (3 items); Alpha = .736

  'I would say I'm strong at quantitative courses'
  'I tend to be a bit uneasy with number crunching'

Methodology cont'd
Sample Items
5 point Likert scales (strongly disagree …. strongly agree)

- **Aptitude for Data Analysis** (4 items); Alpha = .853.

  'I am comfortable with quantitative data analysis'

  'I am confident with analyzing data'

- **Teacher's Influence** (4 items); Alpha = ,851

  'the lecturer/tutor (combined) was excellent for the quantitative research course(s) done on the UWI campus'

  'the teaching techniques utilized in quantitative course (s) done at UWI were not effective in advancing my understanding of quantitative research'.

- **Proficiency with Quantitative Research** (2 items); Alpha = .733

  'I would rate myself as proficient at the level of quantitative research that I have studied'

  'my behavior to quantitative research has been positive after having done quantitative research course(s) at UWI'.

- **Proficiency with Quantitative Research** (1 item); GPA scores

Methodology cont'd

Sample

- The sample consisted of 91 respondents who had all completed quantitative research course(s) at the University of the West Indies, Mona campus, in Jamaica.
- 59%Females & 41% Males
- Faculties:
  - 75% Social Sciences
  - 9% Humanities and Education
  - 9% Pure and Applied Sciences
  - 7% Medical Science

Methodology cont'd

Sample

- Programs:
  - 81% in Bachelor's programs
  - 17% in Masters programs
  - 2% in Doctoral programs

- All respondents were aged 45 years and less:
  - 29% were between 18 and 21;
  - 54% between 22 and 25;
  - 9% between 26 and 30;
  - 6% between 31 and 35
  - 2% between 36 and 45.

Data Analysis and Results

SPSS version 16 was used for describing the sample and testing the predictive model *vis* six factors that could influence proficiency in quantitative research.

Results

Table 1
Means, Standard Deviations and Pearson Correlation Coefficients   N=91

Variables	Means	S.D.	1	2	3	4	5	6
1. Understanding statistics	3.5192	.8895						
2. Competence with statistical software	4.0165	.9928	.597**			**Tol > .10;** **VIF < 10**		
3. Student motivation	3.4368	.8592	.372**	.275**				
4. Quantitative aptitude	3.2747	1.001	.508**	.467**	.504**			
5. Aptitude for data analysis	3.5907	.8720	.766**	.646**	.410**	.576**		
6. Teacher's influence	3.3269	1.111	..353**	.247*	.275**	.378**	.355**	
7. Proficiency in quantitative research	3.4011	.9581	.728**	.527**	.536**	.575**	.709**	.429**

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed)

Results of Regression Analysis on Proficiency in Quantitative Research: Perception vs. Actual Performance

Independent Variables	Model 1 Perception of Performance (LIKERT Scale)			Model 2 Actual Performance (GPA)		
	Beta	S.E.	p-value	Beta	S.E.	p-value
Constant	-.462	.329	.164n/s	1.726	.548	.002***
Understanding statistics	.400	.110	.000***	-.025	.160	.877n/s
Competence with statistical software	.031	.083	.711n/s	.068	.140	.630n/s
Student motivation	.247	.083	.004***	.028	.138	.840n/s
Quantitative aptitude	.085	.082	.302n/s	.166	.135	.223n/s
Aptitude for data analysis	.242	.122	.050**	-.054	.201	.790n/s
Teacher's influence	.101	.060	.099*	.187	.099	.063*
R^2	.663			.109		
Adjusted R^2	.639			.045		
$F_{(6, 84)}$	27.596***			1.7n/s		

Some Comment (RQ1)

- The study provided a validation of Knox's Proficiency Theory of Adult Learning

- Results supported the view that the right attitude (**student motivation**), appropriate knowledge (**understanding statistics and teacher's influence**) and relevant skills (competence with statistical software; quantitative aptitude and **aptitude for data analysis**) are key drivers of self-determined performance in quantitative research

- In the case of skill, only one of its three proxies (aptitude for data analysis) was impactful on performance, making skill a partial driver of self-determined proficiency in quantitative research.

Some Comment (RQ2)

- The study provided a validation of Self Determination Theory: The individual internal feeling about his/her knowledge, attitude and skills will be congruent with internal feelings on performance.

- These internal feelings may not be related to external factors such as grades

Some Comments

- ✓ **For Educators**
  - – The results indicate that helping students to be proficient at quantitative research can be approached on three fronts.
  - – First, students' *attitude* could be aided by teachers who should motivate students to do research. And, while this could be viewed as a contradiction against the notion that students have the responsibility to motivate themselves, it is believed that motivating students through a system of rewards (which could include: verbal recognition, bonus marks or exemption from aspects of course work) could lead to repeat and improved performance.
  - – Other motivational tips that could be employed by teachers of quantitative research are to: encourage and reassure students that they can do the work, use humor and teaching gimmicks for imparting concepts; and generally be more patient and understanding with students who are challenged (Onwuegbuzie, et al., 2010).

Some Comments

- ✓ **For Educators**
    - Second, ***knowledge*** should be enhanced though improving the students' understanding of statistics as this is required for proficiency in quantitative research. Understanding statistics involves the ability to accurately *comprehend*, *interpret* and *evaluate* data; and consequently the teacher should develop the curriculum based on the three benchmarks..
    - Third, ***skills*** should be honed particularly in the area of data analysis. This data analysis process should focus the concept of variables (categorical vs. continuous), the univariate, bivariate and multivariate relationships/ assembling of these variables; and the concepts of hypotheses and statistical testing to be employed based on proposed research questions.
    - And while competence with statistical software and quantitative aptitude cannot be ignored in the skills honing process, it would seem that, these constructs, in and of themselves, will not influence proficiency in quantitative research but could influence data analysis skills which are required for proficiency in this area.

Conclusion/ Future Directions

Contribution

- Study found empirical support for factors that could influence self-determined proficiency in quantitative research

- Study provide validation of two seminal theories

Questions?