What Predicts Student Success in Introductory Data Management Classes? An Investigation of Demographic, Personality, Computer-Related, and Interaction Variables

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Abstract

Introduction to data management classes are often times students' first exposure to advanced material in these areas. Many factors are likely to influence success in these classes, but empirical investigations have focused on relatively few variables. In this study, we extend this research by examining the relative contributions of the previously examined variables of gender and age, as well as the personality (motivation) variables of need for achievement and conscientiousness and the computer-related variables of computer self-efficacy and computer anxiety. Further, we investigate interactions between age and these personality and computer-related variables. We examined these variables in a sample of 204 students. Results revealed that demographic and computer-related variables explained variance in classroom performance, as did three of the four age-variable interactions. Pedagogical implications of these results are discussed as well as directions for future research.

Keywords: Student Success, data management class, classroom performance, Computer self-efficacy, computer anxiety, demographic variables, personality variables

1. INTRODUCTION

Although almost all college students have been exposed to computers, and the majority have been exposed to the basics of programs like Microsoft Excel, an introductory college course on spreadsheet/database management is often their first formal, college-level training on these topics (e.g., Omar, 1991). As this is an entry-level course for many programs of study, subsequent courses often have a vested interest in making sure that learning occurs in these classes. The skills related to managing and analyzing data for usage in decision-making are of great interest to students, instructors, and employers as students progress in their college coursework (Baugh, 2004).

However, students arrive at these classes with different demographic attributes and abilities including their gender, ages, levels of motivation, and computer-related beliefs. These differential student factors often have a considerable impact on how students perform in these classes, thus, it would benefit instructors to know as much as possible about how these variables are associated with classroom success. Although a number of studies have investigated individual level predictors of success in introductory computer-related classes (Bergin & Reilly, 2005, Beise, Myers, VanBrackle, & Chevli-Saroq, 2003), most of these research efforts have only examined a few variables.

This research effort was designed to extend these studies by investigating the influence of six variables, two of which are demographic, two are personality (motivation-related), and two are computer-related variables. The demographic variables we investigate are gender and age, the personality variables are need for achievement and conscientiousness, and the computer-related variables are computer self-efficacy and computer anxiety. Need for achievement and conscientiousness are both motivation-related personality variables. In particular, need for achievement refers to an individual's desire to take on difficult tasks, give high levels of effort, and achieve high levels of performance (McClelland 1985). Conscientiousness refers to an individual's dependability, responsibility, planning and organization skills, and propensity to strive to achieve goals (Costa & McCrae, 1988). Computer self-efficacy is a person's belief about his/her ability to use computers across various situations (Compeau & Higgins 1995; Marakas, Yi, & Johnson, 1998) and computer anxiety focuses on an individual's fear of using computers (Chua, Chen, & Wong, 1999. Not only does this study examine these variables, but it investigates them in the same study so we are better able to determine the relative strength of the variables in comparison to each other. Additionally, this study extends previous studies by investigating the interaction of a student's age on the personality and computer-related variables. These moderation tests are designed to help answer the questions associated with how an individual's age changes the relationships between personality and computer-related variables and success in the classroom. Our hope is that by better identifying the factors that either directly or interactively predict success in these classes, instructors will be armed to use this information in their classrooms.

2. LITERATURE REVIEW AND HYPOTHESES

Demographic Variables

Gender. When investigating demographic variables that may play a role in success in an introductory data management course, gender has often been identified as an important variable (e.g., Bergin & Reilly, 2005; Wilson, 2006). In the educational context, studies have found that women are less likely to have or acquire computer-related competence or confidence. Some of the reasons for this relate to the fact that women as a whole have been shown to use computers less, and as a result often have fewer computer skills and beliefs about their ability to perform well (e.g., Beise, Myers, VanBrackle, & Chevli-Saroq, 2003). Accordingly, we anticipate men will perform better than women in introductory data management classes. Thus, we hypothesize that:

Hypothesis 1a: Males achieve higher GPAs than females in the introductory data management class

Age. Age is another demographic variable that has been related to classroom success in computer-related classes. Some of the reasons for these findings suggest that younger students have had greater exposure to computers, are more comfortable learning new skills on a computer, and have more time to learn assigned material (Segall, Gollhardt, & Morrell, 2007). On the flipside, studies have shown that older students in computer-related classes have some difficulties including anxiety, they tend to be slower to learn, have less computer experience, are too busy to learn the material, and do not see the need (purpose) for learning the material (e.g., Turner, Turner, and Van De Walle, 2007). Based on these arguments, we expect that the age of the student is likely to be negatively related to classroom performance. Thus, we hypothesize that:

Hypothesis 1b: Age is negatively related to GPA in the introductory data management class

Personality Variables as Introductory Data Management Class Predictors

Need for Achievement. Need for achievement is a personality trait characterized by a consistent desire to meet high levels of achievement (McClelland, 1985). Individuals high in need for achievement are more driven, choose more difficult tasks, and strive to perform well. Those high in need for achievement do not shy away from challenges, but often times seek them out (Daft, 2008). Based on the positive motivation and achievement-striving attributes that are characteristic of those high in need for achievement, we anticipate this personality variable to be positively related to performance in an introductory data management class. Thus, we hypothesize that:

Hypothesis 2a: Need for achievement is positively related to GPA in the introductory data management class.

Conscientiousness. Conscientiousness is a personality trait that refers to an individual's responsibility, dependability, and hardworking nature (Costa & McCrae, 1988; Hogan, 1986). Conscientious individuals are reliable, organized, persistent, responsible, and strive to achieve their goals. Based on the characteristics of those high in conscientiousness, it is likely that the personality variable is positively related to classroom performance (Digman & Takemoto-Chock, 1981). For students to succeed in an introductory data management class, they need to be responsible, hard working, organized, and consistent in their work, all of which are related to high conscientiousness. Thus, we hypothesize that:

Hypothesis 2b: Conscientiousness is positively related to GPA in the introductory data management class

Computer-Related Variables As Introductory Data Management Class Predictors

Computer Self-efficacy. Self-efficacy is a personality variable that describes a person's belief in his/her ability to perform a certain task (Bandura, 1997). Computer self-efficacy is a specific type of self-efficacy that refers to an individual's perception of his/her ability to use computers in different situations (Compeau & Higgins 1995; Marakas, Yi, & Johnson, 1998). Overall, research on self-efficacy (including computer self-efficacy) suggests that those who are higher in this belief perceive themselves as more likely to attempt, work hard, and execute assigned tasks and activities (Barling & Beattie, 1983). On the flipside, individuals who are low in self-efficacy are less likely to work hard and complete assignments. Applying this logic to computer self-efficacy, students who are higher in this variable are likely to believe they can complete their computer-related work in a number of different areas. In class, these students are likely to believe they can master the topic and thus work harder and perform better. Thus, we hypothesize that:
Hypothesis 3a: Computer self-efficacy is positively related to GPA in the introductory data management class

Computer Anxiety. Computer anxiety is a variable that has been defined as the fear of possibly using a computer or fear felt when actually using one (Chuaet al., 1999). As opposed to a negative attitude about computers, computer anxiety describes an affective (emotional) response that often comes from the potentially negative outcomes related to computer usage (e.g., damaging equipment, looking foolish, making costly mistakes). In thinking about how computer anxiety is associated with student performance, the negative feelings related to high levels of anxiety are likely to take away from the cognitive resources that students give to completing their work (Kanfer & Heggestad, 1997). As a result, higher levels of computer anxiety are likely to be associated with decreased performance. Thus, we hypothesize that:

Hypothesis 3b: Computer anxiety is negatively related to GPA in the introductory data management class

Age-Personality and Age-Computer-Related Variable Interactions As Introductory Data Management Class Predictors

Although we have hypothesized a number of main effect relationships between different variables and performance in an introductory data management class, we believe that it is important to look at how these variables interact with an individual's age to best predict performance. Exploring these interactions is needed as these variables do not exist in isolation in the real world, although they are most often examined this way, and are likely

to have unique effects when examined in conjunction with an individual's age. In particular, we believe that the impact of the variables we investigate in this study is likely to be changed (either intensified or lessened) for students based on their age. Thus, we predict that:

Hypothesis 4a: Need for achievement and an individual's age will jointly predict GPA in an introductory data management class

Hypothesis 4b: Conscientiousness and an individual's age will jointly predict GPA in an introductory data management class

Hypothesis 4c: Computer self-efficacy and an individual's age will jointly predict GPA in an introductory data management class

Hypothesis 4d: Computer anxiety and an individual's age will jointly predict GPA in an introductory data management class

3. METHOD

Sample and Procedure

The participants in this sample came from students enrolled in an Introduction to Computers in Business class offered in the business school of a medium-sized Midwestern university. The class was required for all business students. In this class, the semester was spent between learning Microsoft Excel and Access, with a specific focus on how to effectively and efficiently compile and analyze both small and large datasets, and use this information to help in making appropriate decisions. To test the impact of the variables to be examined, a survey was given at the beginning of the semester. This survey was approved by the school's IRB board and students were assured that their individual information would not be used, as the instructor was only interested in aggregate data that could help to improve classroom instruction in the future. This survey contained demographic information and assessed personality and computer-related variables of interest. At the end of the semester, the instructor used student performance (grade in the class) as the dependent variable.

In total, the sample was comprised of 204 students over the course of 1.5 years. Students in each of the classes were exposed to the same material and graded the same way. The demographic profile of the students was 52% female, average age of 25.09 years, with students working an average of 29.25 hours per week, taking an average of 10.15 class hours that semester, and having worked an average of 7.94 years.

Measures

Gender. Gender was measured with females coded as a 0 and males coded as a 1.

Age. Age was measured in whole years.

Need for Achievement. Need for achievement was measured with Steers and Braunstein's (1976) 5-item scale (alpha = .71). A sample item was "I do my best work when my job assignments are fairly difficult," with response scales ranging from 1 = strongly disagree to 5 = strongly agree.

Conscientiousness. Conscientiousness was measured with the Goldberg, Johnson, Eber, Hogan, Ashton, Cloninger, and Gough (2006) ten-item scale (alpha = .72). This scale asked respondents to rate how accurately each statement describes them using the following scale: 1 = very inaccurate to 5 = very accurate. Sample statements included "Pay attention to details" and "Follow a schedule."

Computer Self-Efficacy. Computer self-efficacy was measured with Murphy, Coover and Owen's (1989) nine-item scale (alpha = .88). A sample item was "I feel confident about learning a new text-processing program if I am neither aided by a competent person, nor have a good manual or introductory program." The response scale ranged from 1 = strongly disagree to 5 = strongly agree.

Computer Anxiety. We measured computer anxiety with the eight-item scale (alpha = .88) from Marcoulides (1988). A sample item was "I feel anxious whenever I am using computers." The response scale ranged from 1 = strongly disagree to 5 = strongly agree.

Control Variables. In our analyses we controlled for hours worked per week, class hours per semester, and work experience (work tenure measured in years). We controlled for these variables as they are likely to influence classroom performance.

Analyses

A hierarchical moderated regression analysis (Aiken & West, 1991) was used to test the hypotheses. Our analysis had four steps. In the first step the control variables of hours worked per week, class hours this semester,

and work experience were entered. In the second step, we entered the demographic variables of gender and age and it was here that hypotheses 1a and 1b were tested. The two personality and two computer-related variables were entered in the third step, and in this step we tested hypothesis 2a, 2b, 3a, and 3b. Finally, in the fourth step we entered the four two-way interactions formed between age and the personality and computer-related variables, and in this step we tested hypotheses 4a-4d.

4. RESULTS AND DISCUSSION

The means, standard deviations, and intercorrelations between our study variables are provided in Table 1. As can be seen, neither of the demographic variables were significantly related to GPA, but all four of the personality and computer-related variables were. However, to analyze our hypotheses, we needed to include the control variables as well as the other variables we examined all at the same time.

Table 2 provides the results from our hierarchical moderated regression analysis. In step 1, none of the control variables were significantly related to GPA. In step 2, gender was negatively, but not significantly related to GPA, whereas age was both negatively and significantly related to GPA. Thus, hypothesis 1a was not supported, but hypothesis 1b was supported. Although gender was not significantly related, the association was in the predicted direction with men performing better than females. However, the finding that age was negatively related to classroom performance was in line with the extant research and points to the importance of being aware of this fact and potentially doing what is possible to help older students.

In step 3, need for achievement was not significantly associated with GPA, whereas computer self-efficacy and conscientiousness were positively related to GPA and computer anxiety was negatively related. Thus, hypothesis 2a was not supported, but hypotheses 2b, 3a, and 3b were supported. These findings point to the importance of investigating certain areas of personality and computer-related variables. Additionally, we found that one computer-related variable (computer self-efficacy) was positively related to GPA, whereas another (computer anxiety) was negatively related to our outcome of interest. As a result, the motivation (conscientiousness), computer-related anxiety and self-efficacy that students bring to the classroom are likely to play strong roles in how well they perform. Armed with this knowledge, it is important to find out what contributes to these variables and how instructors can use this information to help all of their students succeed, not just those with the optimal variables when entering an introductory data management course.

Finally, step 4 in Table 2 reveals that except for the age*conscientiousness interaction, the three other interactions were significantly related to GPA in the introductory data management class. Thus, hypothesis 4b was not supported, but hypotheses 4a, 4c, and 4d were supported. Graphical representations of these interactions are provided in Figures 1-3.

Figure 1: Interaction of Age and Computer Self-Efficacy

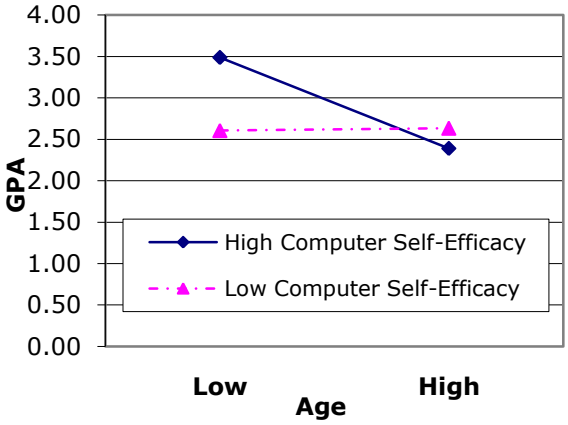


Figure 2: Interaction of Age and Need for Achievement

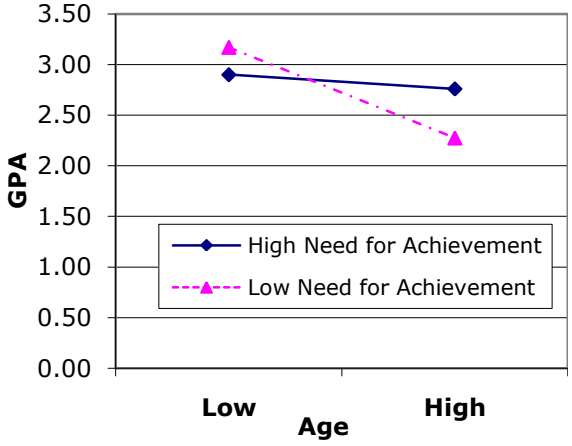
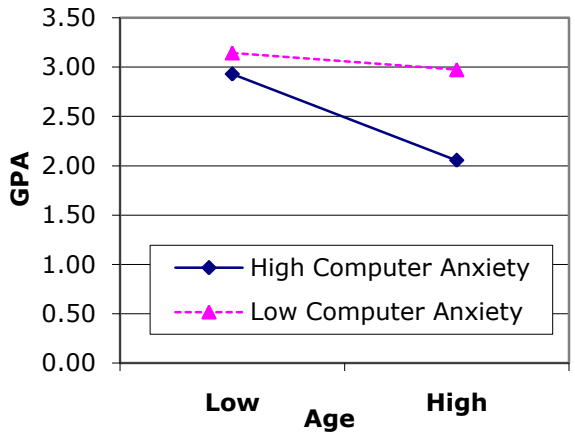


Figure 3: Interaction of Age and Computer Anxiety



As can be seen, the negative relationship between age and GPA was stronger when computer self-efficacy and computer anxiety were higher, and when need for achievement was lower. It was anticipated that the interaction for computer self-efficacy and age would predict students' class performance but the results indicate that age and this variable work together differently than expected. On the other hand, the other two significant interactions with age were as would be anticipated. In particular, the negative impact of low need for achievement and high computer anxiety enhanced the strength of the relationship between age and GPA. Thus, for these individuals, age by itself had a negative impact on classroom performance, but when combined with either low need for achievement or high computer anxiety, the classroom performance was much worse. Based on these findings, instructors should be aware that when older students have either of these variables (low need for achievement or high computer anxiety), their grade in an introductory data management class has the chance to be at its lowest. Overall, these findings help to inform instructors about potential student expectations and might provide guidance about which individual or groups of students might need additional instruction to succeed in introductory data management courses.

5. DIRECTIONS FOR FUTURE RESEARCH

Although our study helped to further the research in this area in a number of ways (e.g., identify possible predictors of student success in an introduction to data management course), we feel that it also elicits a number of other related research questions. First, as we found a number of significant interactions between age and personality and computer-related variables, it brings up questions of other interactions. For example, does age interact with variables such as locus of control, learning style, or internal motivation in predicting class success? Alternatively, do some of the personality and computer-related variables we examined interact with other demographic variables (e.g., work experience, gender, race) to better explain classroom performance? We chose not to examine some of these other interactions as the focus of our study was on two personality variables, two computer-related variables, and the interactions of all four variables with age, and we felt that examining too much in one study could potentially cause the reader to lose focus or unnecessarily complicate our results. A second avenue for future research could be to investigate other factors in the same study that are likely to play a role in how well a student performs. Some of these other factors might include a student's reason for taking the class (e.g., required, want to learn, need it for a job) (Wang & Newlin, 2002) or expectations about the class including expected difficulty or amount of time required to master the material. A third and final area for future research would be to investigate long-term outcomes such as success in using computers, long-term knowledge acquisition, post-class perceptions of computer self-efficacy and computer anxiety. Our study investigated one of, if not the most important short-term outcome (class grade), but looking at outcomes a semester, a year, or even two later would be interesting and important for both students and educators.

6. CONCLUSION

Overall, this study set out to extend research on student success in introductory data management courses. We accomplished this by examining demographic, personality, computer-related, and interaction variables as predictors of success. Our results suggest it is important to look at many variables to see their relative explanatory power, and also to

look at interactions, as the combination of variables truly reflect reality and help to shed light on how different personality and computer-related variables are more or less important depending on a student's age. From a pedagogical perspective, we feel our findings provided valuable information for instructors in terms of what they can expect, tips for the classroom, and information and which students are more or less likely to succeed in introductory data management courses. Additionally, our study informs pedagogical researchers about these topics and we hope future studies will continue to investigate more questions in these areas.

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APPENDIX

Table 1 Means, Standard Deviations, and Intercorrelations of Study Variables

Variable	Mean	SD	1	2	3	4	5	6	7	8	9
1. GPA	2.53	1.35	-								
2. Hours Worked Per Week	29.25	12.27	-.04	-							
3. Class Hours This Semester	10.15	4.11	-.08	-.34**	-						
4. Work Experience	7.94	6.39	.07	.21**	-.39**	-					
5. Gender	0.48	0.50	-.10	.01	.07	-.05	-				
6. Age	25.09	7.09	-.02	.21**	-.45**	.82**	-.09	-			
7. Computer Self-Efficacy	3.70	.67	.23**	-.02	.08	-.07	.14*	-.13*	-		
8. Need for Achievement	3.94	.47	.19**	.10	-.07	-.02	.05	-.09	.36**	-	
9. Computer Anxiety	1.76	.62	-.30**	.05	-.01	.06	-.07	.11	-.47**	-.31**	-
10. Conscientiousness	3.88	.48	.20**	.10	-.24**	.26**	-.15*	.24**	.01	.26**	-.15*

N=204; * p<.05; ** p<.01

Table 2 Results of Hierarchical Moderated Regression Analyses on GPA

	Step 1	Step 2	Step 3	Step 4
Control Variables				
Hours Worked Per Week	-.01	-.01	-.01	-.01
Class Hours this Semester	-.03	-.04	-.03	-.03
Work Experience	.01	.06*	.05	.05
Demographic Variables				
Gender		-.28	-.32	-.37*
Age		-.06*	-.04*	-.04
Personality and Computer Variables				
Computer Self-Efficacy			.24*	.23*
Need for Achievement			.12	.13
Computer Anxiety			-.45**	-.46**
Conscientiousness			.35*	.33
Interactions				
Age*Computer Self-Efficacy				-.06*
Age*Need for Achievement				.06*
Age*Computer Anxiety				-.04*
Age*Conscientiousness				-.02
Change in R^2	.01	.04*	.11**	.04*

N=204, Unstandardized regression coefficients are provided; * p<.05; ** p<.01