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Building Math Confidence in Classroom Learning Using Microsoft Excel

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Abstract

Math anxiety is experienced by students across disciplines and is believed to have reduced students' career options, particularly in science and technology. Many factors contribute to this malady. Instructors, with their responsibilities and resources, should strive to exert a positive impact on their students in building math confidence in classroom teaching. The purpose of this study focused on whether positive reinforcement enhanced students' ability to deal with math and math-related problem solving skills. Using Microsoft Excel as a tool, students were encouraged to build their math confidence by working on application exercises designed to be meaningful and practical. Implications of this study included incorporating teaching and learning strategies in curriculum to achieve the desired goal in helping students build math confidence.

Introduction

The changing economy of America in this new century has witnessed the fastest-growing industries in information technology, computer science and engineering. Professionals, engineers and technicians will see their incomes increase in many years to come. The future workforce, the current students at schools, colleges and universities, however, present an imbalanced picture. According to *Workforce 2020* (Judy & D'Amico, 1997), at the college level, white students are more likely to be education majors and blacks and Hispanics business majors while more Asian students major in engineering. There is some shift at the graduate level with Asian students receiving the highest share of master's degrees in business and engineering and doctorates in engineering and physical and life sciences. At the same time, elementary and secondary schools have been experiencing an increasingly short supply of qualified math and science teachers. It is believed that capable students reduce their options in careers while avoiding math study and erode the country's resource base in science and technology (Hembree, 1990). Students of different ethnic/racial backgrounds should be encouraged to choose majors of which there is a huge demand of the labor market and of more promising employment prospects.

There is a wide array of reasons why students choose some majors and avoid others. One reason is the perceived apprehension of math and mathematics-related fields. Students experiencing math anxiety may avoid math classes (Felson & Trudeau, 1991) and develop negative attitudes toward mathematics-related activities (Gressard & Loyd, 1987), and the accompanying worries may disrupt their mental processes for developing math competence (Ashcraft, 2001). Students are constantly influenced by “stereotype

threat” that they are not good at math and this attitude can be reinforced by family, friends, teachers, and their own consciousness (Fotoples, 2000). The poor attitudes toward mathematics even have negative impact on self-concept and feelings of competence (Sherman & Christian, 1999).

Literature Review

Studies have found affective factors correlates more strongly with children’s perception of their math capability and performance than cognitive factors (Wigfield & Meece, 1988). Individuals with high math anxiety demonstrated short working attention spans, especially when assessed with a computation-based task. This may cause significant increase in reaction time and errors when performing math tasks (Ashcraft, 2001). In the study of the institutional and student factors and their influence on advanced mathematics achievement, Schreiber (2002) found that affective background factors did play an important role in math achievement. Students with poor attitudes toward math tended to perform poorly on tests. This was also true for the most advanced students. He observed that in some schools, this strong relationship between math attitude and achievement was not present, suggesting that institutional factors, i.e. schools and teachers who may help students reduce the impact of poor attitude.

Negative stereotypes threaten the individuals who are targeted and interferes with intellectual test performance (Steele & Brown, 1999). For example, white male students who were told to be inferior to Asian students in math experienced disruptive situational pressure that adversely affected their achievement. This threat may result from the poor rankings American students have in international mathematical performance. Yet, further analysis of mathematical performance indicated different strategies were employed by

students in different countries to solve mathematic problems (Cai, 2001). Cai discovered that American students outperformed Chinese students on tasks requiring non-routine problem solving skills and creative thinking while outperformed by Chinese students in tasks requiring computation and application of formulas. Students need to be informed that the stereotype threat plays a negative role in their perception of their math capabilities. Students should be encouraged so that they develop the concept that math aptitude can be improved by learning and practicing. Students need to see specific examples with clear verbal explanation that detail a logical sequence in the process (Schwartz, 2000) and applications are essential to make math meaningful and of practical use to students.

Purpose of the Study

In teaching WED 306 (Introduction of Computer Information System), an undergraduate course offered by the department of Workforce Education and Development(WED) at Southern Illinois University at Carbondale (SIUC), the instructor perceived students' anxiety in using formula, functions and logical test to solve math problems when learning software application of Microsoft Excel. This anxiety was evidenced by the frustration and comments expressed by the students. The purpose of this study focused on whether positive reinforcement of students' competency in working with math, and clearly explained, step-by-step application exercises designed to be of meaningful and practical use to the students could help build math confidence. Three research questions were proposed in this study:

1. Does math anxiety have an impact on how students perceive the use of Microsoft Excel?

2. Do the instructional strategies influence the level of math anxiety after the learning experience of Microsoft Excel?
3. How do students feel about using Microsoft Excel to solve math problems?

Methods

Population

Convenient samples of students in intact classes enrolled in the course WED 306 were used. A total of 47 subjects, 22 in spring and 25 in fall semester of 2003 participated in the study on a voluntary basis.

Design

The pilot study was conducted testing the survey questionnaire during spring semester of 2003, which also provided some baseline data of students' attitudes towards math and math confidence. Questionnaire was refined as a result, and in fall semester of 2003, a pre and post survey methodology was used to determine if instructional strategies incorporated in learning the Microsoft Excel influenced students' math confidence.

Instrument

Survey questionnaire items were developed by adapting the existing instrument *Math Anxiety Questionnaire (MAQ)* (Wigfield & Meece, 1988) and items regarding using Microsoft Excel were added. The instrument was modified following the pilot test in spring semester of 2003 and the reliability of the instrument was 0.837. Students were asked to check how they feel about the statements under four categories – Strongly Disagree, Somewhat Disagree, Somewhat Agree, Strongly Agree – which were coded from 1 to 4. A low score indicated low math anxiety and less concern about using Excel to solve math related problems. The open-ended questions were added for more in-depth

information to students' responses. Also, for the post-survey, additional questions regarding the learning experience and use of Excel were included.

Procedures

In the sixth week of the fall semester of 2003 when students started to learn Excel, the pre-survey questionnaires were distributed and baseline data were collected. Then, instructions on Microsoft Excel and hands-on application exercises focused on problem-solving followed. The students, for example, were told that they would be expected to manage their gradesheet for this class and update the sheet to keep track of their "current status" for the course. This would be the first assignment of Excel and full credit of 20 points would be given at the end of the semester provided that the information was correct and current. Working with formulas and functions was incorporated while students were guided through their creation of their gradesheets. Creativity was encouraged in format and layout. Skills were then introduced to develop professional-looking worksheets and students were free to use features in Excel to enhance the gradesheet.

When students saw the results of their work (entering points they had earned and the total possible to obtain percentage of their current status), the instructor reiterated the main steps of using formulas and functions, and encouraged students to develop similar sheets to manage their grades for other classes so that they could have concrete reference to their GPA goals. When the majority of the students demonstrated their ability to handle their gradesheet, the instructor "asked for help" from the students to work on a made-up gradesheet, of which each examination/assignment had a different weight. Sorting and logical test were introduced together with more functions such as descriptive

statistics of mean scores to compare the performance of different groups. A homework assignment of payroll was given to reinforce the learning in class. The instructor received two emails concerning the assignment; both were having the same problem with the order of precedence in the formula. The instructor replied that the whole class would go over the assignment together during the next meeting. Other problems observed in class were related to the use of Excel, such as relative and absolute cell references.

The instructor suggested some extra credits for developing a personal budget sheet which students could use for managing their own incomes and expenses, and the response from the students were positive. The whole class brainstormed the categories to be included but tailored to individual situations. The practices and assignments were designed to motivate students solve math-related problems using Microsoft Excel. Student not only learned and reviewed the steps in the software application, but also visualized the practical and meaningful use of their work.

Throughout the process, the instructor reassured the students that they could handle these math problems and with the help of Excel, achieve the goal more efficiently. At the end of the program unit, students were given the post-survey questionnaires.

Data Analysis

The results were analyzed using SPSS 10 version. Spearman's correlation was used to test the relation between the items of math anxiety and Excel. Items related to math anxiety and Excel in the pre and post survey were tested separately using Wilcoxon Signed Ranks Test. Since only 22 paired sample scores were obtained for the pre and post survey, research questions 1 and 2 were answered based on the analysis of 22 scores as shown in Table 1, Table 2 and Table 3. To answer research question 3, students'

responses to the use of Excel in handling math problems were solicited during the post survey. A total of 25 responses were collected and analyzed. Comments of open-ended questions in the pre and post survey added perspectives to the quantitative analysis.

Results

Research question 1: Does math anxiety have an impact on how students perceive the use of Microsoft Excel? It was shown that students who had higher math anxiety were more likely to be concerned about using Excel to work out math problems. Table 1 indicated such a correlation at the significant level.

Table 1

Correlations between Math Anxiety and Excel

			Math	Excel
Spearman's rho	Math	Correlation Coefficient	1.000	.622**
		Sig. (2-tailed)	.	.002
		N	22	22
	Excel	Correlation Coefficient	.622**	1.000
		Sig. (2-tailed)	.002	.
		N	22	22

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

Research question 2: Do the instructional strategies influence the level of math anxiety after the learning experience of Microsoft Excel? Among the 6 items regarding math anxiety, two had lower ranks in the post survey as compared to the pre survey that were statistically significant, as illustrated in Table 2 and Table 3.

Table 2 & Table 3

Wilcoxon Signed Ranks Test – Changes in the Levels of Math Anxiety

		N	Mean Rank	Sum of Ranks		
POSTM5 - PREM5	Negative Ranks	6	3.50	21.00		
	Positive Ranks	0	.00	.00		
	Ties	16			Z	-2.449
	Total	22			Asymp. Sig. (2-tailed)	.014

Item #5: I dread having to do math.

		N	Mean Rank	Sum of Ranks		
POSTM6 - PREM6	Negative Ranks	8	5.88	47.00		
	Positive Ranks	2	4.00	8.00		
	Ties	12			Z	-2.070
	Total	22			Asymp. Sig. (2-tailed)	.038

Items #6: I do math problems just to fulfill the requirement of the class.

Research question 3: How do students feel about using Microsoft Excel to solve math problems? On the learning experience and use of Excel, a significant majority agreed on “Excel helps me handle math problems more efficiently” (Table 4), and “I would recommend to others who work with math problems” (Table 5); but not on “I am more motivated to do math problems that are relevant to my daily life” and “I plan to use Excel to continue my personal budget sheet”.

Table 4 & Table 5

Students' Perception of Excel

Excel helps me handle math problems more efficiently

		Category	N	Observed Prop.	Test Prop.	Exact Sig. (2-tailed)
EX1	Yes	1.00	19	.76	.50	.015
	No	2.00	6	.24		
	Total		25	1.00		

I would recommend Excel to others who work with math problems

		Category	N	Observed Prop.	Test Prop.	Exact Sig. (2-tailed)
EX4	Yes	1.00	21	.84	.50	.001
	No	2.00	4	.16		
	Total		25	1.00		

Students' written comments substantiated the above analysis. It was generally believed that, when working with math problem, Excel "is simple and save time", "can make it a lot faster", "is easy and efficient", "does the work for you", "helps to organize", with its "built in calculations", and "functions, sum, average, max, min are useful".

Discussion

It is not an easy task to change deep-rooted attitudes towards math and math competency, and would be unrealistic for instructors to aim for boosting students' math confidence in a relative short time. Several encouraging themes did emerge from the studies. First of all, 2 out of 6 measures of math anxiety were lower at post-survey at a significant level, which corresponded to participants positive attitudes towards using Excel to handle math related problem. Secondly, a majority would recommend Excel to others for math problem-solving. Since the course covered all major programs in Microsoft Office Suite, and each program lasted for about two and half weeks with three hours per week, students reported not have enough time to practice other than finish the required assignments. Although students reported positive experience in using Excel to manage personal finance, some indicated that they would not continue this project since they had been using other software programs, such as Microsoft Money. Instructors may choose to ask student identify possible project topics relevant to their work and daily life, which potentially would increase the possibility of continuation. Curriculum also needs to be adjusted to accommodate long-term projects.

This study had several limitations due to the research design and sample size. In research studies involving educational settings, it is often not feasible or ethical to randomly assign participates into the experimental or control group. It is especially true

in this case, as literature proves the positive impact of contextualized and applied learning. To improve the validity of the study, the researcher emphasized the voluntary and anonymous nature of the study before the treatment to minimize any experimenter-expectancy effect. Secondly, due to the seat limits of the computer lab, a maximum of 15 students could enroll in any section. A sample size smaller than 30 is generally believed to have limited power of inference to a large population. Therefore, caution must be taken to generalize the findings.

It was the intent of the researcher to explore the possibilities of integrating practical and relevant application in the teaching process to address the perceived math anxiety. This was evidenced by the responses to the pre survey items, in different formats. In order to avoid defensive response, the researcher asked students' perception of their peers' attitudes towards math. Three major themes emerged, with a majority felt their peers, just like them, had negative attitudes towards math. The following comments were representative: "Hardly anyone likes it, and gives up easily"; "Math is difficult, I don't want to take math course anymore"; "A lot of my peers do not like math"; "most of my friends, prefer others to math"; "They hate it"; "I don't think negative outlooks about math will ever disappear"; "It's not exciting"; "It doesn't seem to be a common strength". Several responded the neutral attitudes, and thought some of their peers liked math, and others hated it. The last categories, although smallest in number, actually reflected the students' own perceptions. Quotes such as "I don't know, probably more comfortable with math than I am"; "my peers appears to be calm and confident", implied math anxiety of the participants.

In a relative short time period of instruction covering Excel program, some students still felt challenged to finish all the tasks in such an introductory class without prerequisites. Comments from the open-ended questions in the post survey did clearly indicate, however, that students enjoyed the learning experience with Excel solving math problems. Students reported, among other comments, that “The program was hard to learn but after learning it was found to be easy to do math problems”; “Very interesting, good learning experience, will use later in life”; One student in particular saw how this learning experience could be applied elsewhere. “It was very exciting. I learned a lot of things using Excel that will help in teaching my son math problem”.

Although only two statistically significant changes were found regarding math confidence among participants after using instructional strategies, positive learning experiences reported by the students did indicate the potential of instructors’ role in helping students overcome math anxiety by incorporating teaching and learning strategies in the curriculum. Future researches can look into the issue from different perspectives or duplicate the practices with a larger sample size for more generalizability.

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