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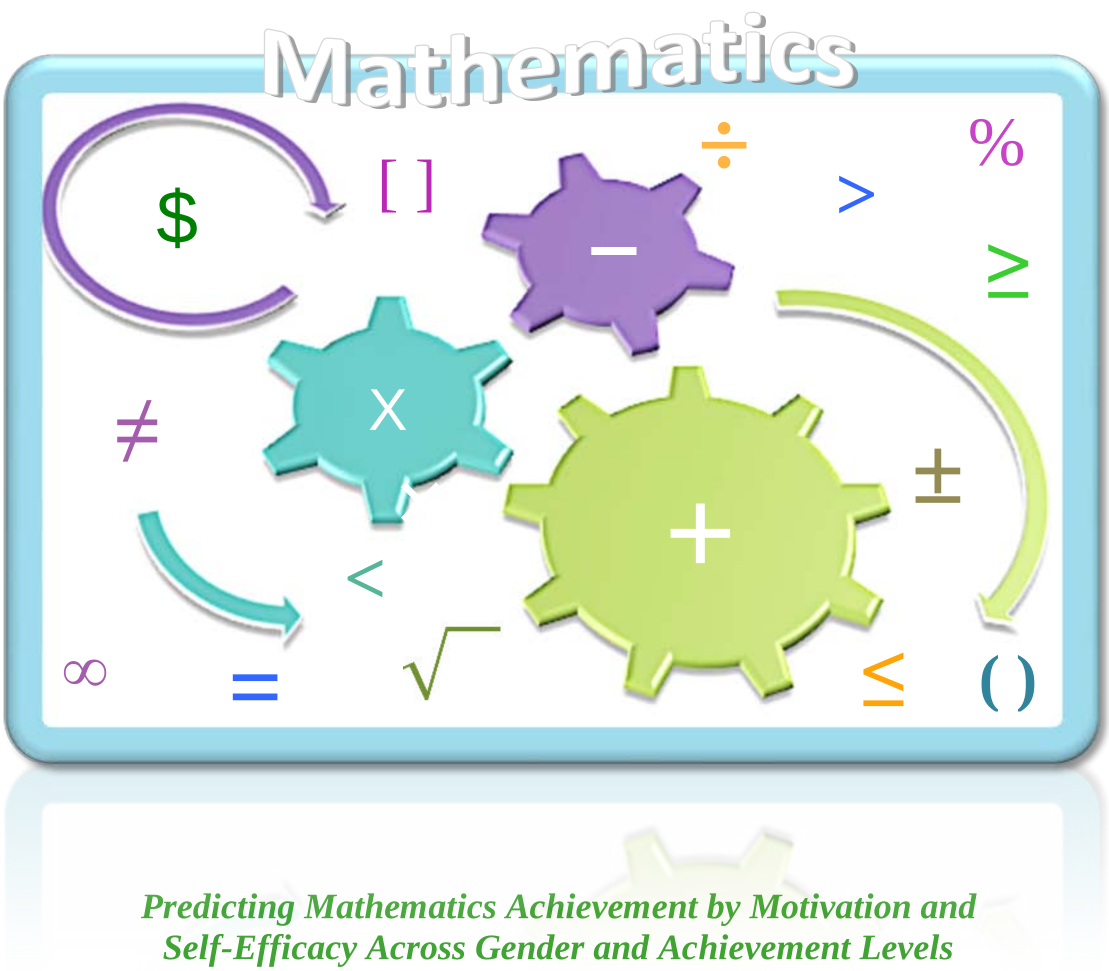

Predicting Mathematics Achievement by Motivation and Self-Efficacy Across Gender and Achievement Levels

Insurance and Mathematics: Developing Democratic Citizenship Through Interdisciplinary Approaches to Contemporary Issues

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Interdisciplinary Journal of Teaching and Learning
Volume 2 Number 2 Summer 2012

Message from the Executive Editor

Vera I. Daniels
Joseph Kermit Haynes-Casino Rouge Endowed Professor

The focus of this issue of the *Interdisciplinary Journal of Teaching and Learning* is mathematics. Although we did not set out to publish a themed issue, this publication emerged as a themed issue in an area of education that is internationally recognized as a discipline that transcends all cultures.

Mathematics plays a vital role in our everyday lives, and almost everything we do can be connected in some way to mathematics. Mathematics can equip students and professionals with interesting, innovative, creative, resourceful, and powerful ways to analyze, describe, and change society and the world.

The first article in this issue of the *Interdisciplinary Journal of Teaching and Learning* presents research on self-efficacy and motivation as predictors of mathematics achievement across gender and achievement levels. The second article emphasizes the interdisciplinary teaching of mathematics with the concepts of insurance and social studies.

The *Interdisciplinary Journal of Teaching and Learning* provides a venue for innovative, critical thinkers to present their work on effective teaching and learning. We hope that you will consider this journal as a publication outlet for your work.

Board of Reviewers

Purpose

The Interdisciplinary Journal of Teaching and Learning (IJTI) - formerly the E-Journal of Teaching and Learning in Diverse Settings, is a scholarly, triple-blind, peer reviewed, open access electronic refereed journal that is published three times each year by the College of Education at Southern University - Baton Rouge. Publication occurs in the Spring, Summer, and Fall.

The IJTL is designed to provide opportunities for divergent ideas, views, and opinions on various topics and issues from professionals in diverse disciplines and professional arenas. It strives to be highly interdisciplinary in content that is likely to be of interest to teachers, principals, other school administrators, policymakers, graduate and undergraduate students, researchers, and academicians.

Manuscripts that focus on special education, general education (including subject content areas), bilingual education, cultural and linguistic diversity, innovative methods in teaching, assessment, exemplary programs, technology (assistive and instructional), educational leadership and reform, public policy, current issues and practices, and research relevant to education are encouraged.

Manuscripts submitted to the IJTL should be interesting, thorough, innovative, informative, well-documented, and have practical value that embraces and contributes to effective teaching and learning.

Call for Manuscripts

The Interdisciplinary Journal of Teaching and Learning (IJTL) welcomes submissions that contributes to effective teaching and learning. It provides a forum for the dissemination of articles focused on a wide variety of topics and content subject areas.

The IJTL is comprised of four departments -- Feature Articles, Educational Tweets, Online Resources, and the Event Zone.

Feature Articles provide scholarly articles on important topics, theoretical perspectives, current issues, practices, strategies, and research related to teaching and learning in PK-12 and higher education settings. All manuscripts submitted to this department undergo a triple-blind peer review.

Manuscripts for feature articles may be submitted by faculty, graduate students (whose work is co-authored by faculty), school administrators, policymakers, researchers, classroom teachers, and other practicing educators on current and compelling educational topics, issues, practices, and concerns at all levels (PK-12 and higher education) from a wide range of disciplines.

Manuscripts that focus on special education, general education, bilingual education, cultural and linguistic diversity, innovative methods in teaching, assessment, exemplary programs, technology (assistive and instructional), educational leadership and reform, public policy, current practices and issues, and research relevant to education are encouraged. The manuscripts should be interesting, informative, well documented, appeal to the IJTL diverse audience, and have practical value that embrace and contribute to effective teaching and learning.

Additionally, the manuscripts should be original, well written, and offer new knowledge or a new and insightful synthesis of existing knowledge that has significance or importance to education. They should also have a solid theoretical base and offer an appropriate blend of teaching and practice. The conclusion, summary, final thoughts, or implications should be supported by the evidence presented.

The complete review process for manuscripts submitted to this department may take up to three months. The author guidelines provide additional information on what you should know about the submission process.

Educational Tweets feature brief informative tidbits, views, and opinions on hot topics, current events/issues, educational policies, interesting readings, and other areas that impact education or inform teaching and learning. The information, views, and opinions tweeted in this department reflect those of the author.

Papers submitted to Educational Tweets are limited to 350 words and are generally solicited by the section editors. Persons interested in submitting a paper should make an inquiry. Include in the subject line "Educational Tweets".

Online Resources highlight Internet Websites that provide information on instructional resources for PK-12 classroom and preservice teachers as well as resources that may be of interest to school administrators and teacher education faculty in higher education. Resources featured in this department are generated by the section editors.

The Event Zone features educational events such as conferences, meetings, workshops, forums, professional development opportunities, and webinars sponsored by various agencies and organizations that embrace effective teaching and learning. Events featured in this department are generated by the section editors.

Submission Deadlines		
Spring 2013 (March/April)	**Summer 2013 (July/August)**	**Fall 2013 (October/November)**
Manuscript Deadline November 15, 2012	Manuscript Deadline February 15, 2013	Manuscript Deadline May 15, 2013

Author Guidelines

The Interdisciplinary Journal of Teaching and Learning (IJTL) is a scholarly, triple-blind, peer reviewed, open access electronic refereed journal that welcomes manuscripts from scholars, academicians, teachers, researchers, graduate students (whose work is co-authored by faculty), administrators, practitioners, and policymakers on a variety of topics and content areas as well as educational issues, evidence-based practices, and topics of educational significance.

Manuscripts submitted must be an original contribution that has not been previously published (in whole or substantial part), or is being concurrently considered for publication by another publisher. A cover letter stating these conditions should accompany the submission.

Manuscripts must be submitted electronically using word processing software. Acceptable formats include Microsoft Word (doc /docx) and Rich Text format (rtf).

Manuscripts should be formatted for printing on standard 8 x 11 inch paper with 1-inch margins, double spaced (including quotations and references), and prepared in Times New Roman 12-point font size. Titles, headings, and subheadings should be in upper and lower case fonts.

Manuscripts should not exceed 25 pages in length, including the title page, abstract, references, and tables or figures.

A separate cover sheet should provide the author's full name, organization or institutional affiliation, mailing address, phone number, and e-mail address; and the corresponding author should be identified. The author's name should not appear on any other pages of the manuscript. It is the responsibility of the corresponding author to notify the corresponding editor of the IJTL of changes in address, organization, or institutional affiliation occurring during the review process.

An abstract (100 - 150 words) should be included that summarizes the content of the manuscript. Five or six key words should be placed below the abstract.

Tables and figures should be placed in a separate file, and need not be double-spaced. Tables should only be used when appropriate and should include only essential data. Figures should be camera ready. Indicate the location for tables and figures in the text in boldface, enclosed in brackets, on a separate line.

The author is responsible for the accuracy and completeness of all references. References should be double-spaced and follow the specifications of the 6th edition of the *Publication Manual of the American Psychological Association*. The author is also responsible for obtaining permission to use copyrighted material, if required.

Photos or artwork must be camera ready. The acceptable electronic format is jpeg of at least 300 dpi. Authors should never assume that material downloaded or extracted from the Internet may be used without obtaining permission. It is the responsibility of the author to obtain permission, which should accompany the manuscript submission.

Submit completed manuscripts or inquiries to the editor at coeijtl@subr.edu. The IJTL is published by the College of Education under the auspices of the Executive Editor, Vera I. Daniels, Joseph Kermit Haynes-Casino Rouge Endowed Professor, Special Education Programs, Southern University and A & M College, P. O. Box 11298, Baton Rouge, Louisiana 70813. Telephone/Fax (225) 771-5810.

Review Process

Manuscripts submitted to the IJTL undergo a triple-blind peer review. All identifying information about the author is removed to ensure that the author's identity is not revealed.

Manuscripts received will be screened by the journal editors for conformity to the editorial guidelines, appropriateness of topic, and appropriateness for the journal readership. Manuscripts will also be assessed for content, relevance, accuracy, and usefulness to those in educational settings and stakeholders with an interest in educational policies and issues.

Appropriate manuscripts will be sent to peer reviewers. Poorly written or incorrectly formatted manuscripts will not be sent out for peer review.

All manuscripts received by the IJTL are assigned an identification number that is used to track the manuscript during the review process.

Within two weeks of receipt of the manuscript, an e-mail acknowledging receipt of the manuscript with notification of the assigned identification number will be sent to the author. The author may contact the journal corresponding editor at any time during the review process to obtain information about the status of their manuscript. Include in the subject line "Request for Manuscript Status Update (Manuscript #___)."

The manuscript review process is generally completed within three months. This process may be slightly longer during major academic breaks or holidays.

Peer reviewers make one of the following decisions concerning a manuscript: (a) accept for publication (b) accept for publication and request minor revisions, (c) consider for publication after major revisions with the stipulation for a second peer review, (d) reject with resubmission invited, or (e) reject and decline the opportunity to publish.

Authors of manuscripts that have been accepted for publication will be notified by e-mail through the corresponding author. In some instances, authors may be asked to make revisions and provide a final copy of the manuscript before it is forwarded for publication.

Manuscripts accepted for publication may be susceptible to further editing to improve the quality and readability of the manuscript without materially changing the meaning of the text. Before publication, the corresponding author will receive an edited copy of the manuscript to approve its content and answer any questions that may arise from the editing process.

The IJTL is always looking for peer reviewers to serve on its Board of Reviewers. If you are interested in being considered as a peer reviewer, click on the link Peer Reviewer to obtain an application. Please return the application by e-mail (coeijtl@subr.edu) or fax (225-771-5810).

Predicting Mathematics Achievement by Motivation and Self-Efficacy Across Gender and Achievement Levels

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This study investigated the extent to which self-efficacy and motivation served as a predictor for mathematics achievement of fifth grade students in United Arab Emirates (UAE) across gender and achievement levels. Self-efficacy was measured by two scales, which differed in levels of specificity—Category Specific and Task Specific. Motivation was measured through four sub-constructs of motivation—Amotivation, External Regulation, Introjected Regulation, and Intrinsic Motivation. A total of 287 fifth grade students with an average age of 10.3 years were randomly selected to participate in this study. The multiple regression model showed that the six predictors were able to explain together high percentage (32%) of the variance of mathematics achievement. Also the results indicated that the best three predictors were Task Specific, External Regulation, and Intrinsic Regulation. When conducting the regression model across gender, the results showed that 30% of the variance in mathematics achievement was explained by the six predictors for the male group while only 21% of the variance was explained for the female group. The regression model was not invariant across achievement levels. While the model predicted approximately 20% of the variance of mathematics achievement for each of the low and high achieving students, the model was not statistically appropriate for the medium achievement students as it predicted only 5% of the variance of mathematics achievement. Additionally, the performance of the six predictors varied according to the achievement level.

Keywords: mathematics, self-efficacy, gender, academic performance, intrinsic motivation, extrinsic motivation, amotivation, external regulation, introjected regulation

Over the past three decades, much attention has been focused on mathematics education in relation to self-efficacy beliefs, motivation, and mathematics achievement (Bandura, 1986; Klassen, 2004; Pajares, 1996). Self-efficacy research evolved from the works of Albert Bandura (1977), who theorized that one's beliefs about his/her capabilities are strongly related to the way he/she behaves and learns. According to Bandura's (1986) *Social Cognitive Theory*, self-efficacy beliefs play a major role in human development. Self-efficacy influences people's motivation, the efforts they are willing to exert, and the degree to which one may persist or persevere when carrying out tasks. In fact, self-efficacy has also been shown to affect one's self-concept and self-esteem. In addition, Bandura (1986) made a clear distinction between self-efficacy beliefs and the outcome expectations of one's actions. Outcome expectations depend more on people's judgment of what they can accomplish rather than their beliefs about their academic capabilities. Although there is a positive relationship between the two, this form of relationship is not always consistent (Usher & Pajares, 2009).

A substantial body of research shows the predictive value of self-efficacy beliefs and students' academic achievement across all areas and levels and students' career choices (Brown & Lent, 2006; Pajares & Urdan, 2006). According to this research, students who are more confident in their capabilities tend to work harder, solve problems more efficiently, monitor their progress regularly, and hence, achieve better than their able peers who do not have high self-efficacy. Similarly, experiencing failure will have a negative impact on one's self-efficacy (Brown & Lent, 2006).

Pajares and Miller (1994) found that mathematics self-efficacy was more predictive of problem solving than was mathematics self-concept. Further, they found that self-efficacy played a meditational role on the effect of gender and prior experience on mathematics self-concept, perceived usefulness of math, and math problem-solving performance. These researchers also noted that even when there were gender differences in self-concept and mathematics performance, these differences were ascribed to differences in self-efficacy beliefs. That is, ". . . the poorer performance and lower self-concept of the female students were largely due to lower judgments of their capability" (p. 200). Thus, Pajares and Miller recognized the value of self-efficacy beliefs not only in explaining students' motivation, but also in informing school practitioners as to how to strengthen competence and confidence in students.

In a more recent study, Stevens, Olivarez, Lan and Tallent-Runnels (2004) evaluated self-efficacy and motivational orientation in 358 Hispanic and Caucasian students in grades 9 and 10. They found that self-efficacy strongly predict mathematics achievement and motivation across ethnicity.

Individuals develop self-efficacy beliefs from four underlying sources—mastery experience, vicarious experience, social persuasions, and emotional and physiological states (Bandura, 1977). According to Bandura, the first and most powerful source, mastery experience, refers to one's interpretation and evaluation of results; whereas, vicarious experience refers to students' interpretation of their capabilities in relation to the performance of others. In other words, students compare themselves to others like classmates, peers, and even adults. In addition to comparing themselves to others, students build their self-efficacy beliefs through social persuasions and encouragement, which they receive from others such as parents, teachers and loyal friends. Finally, the emotional and physiological states of an individual serve as a source of one's efficacy beliefs. If an individual engages in a particular behavior and experiences anxiety for example, he or she will be less likely to participate in that behavior again.

In regards to motivation, Haj Hussein, AlSawaie, Alghazo, Tibi, and Sartawi (in press) attempt to explain the concept of "motivation" and its impact on academic achievement. The approach primarily used to explain this phenomenon is the Self Determination Theory (SDT). The SDT postulates that motivation is not a unitary phenomenon, it varies in quantity and quality among people. After reviewing numerous studies, Haj Hussein et al. (in press) asserted that motivation is a complex phenomenon consisting of three different types—intrinsic motivation, extrinsic motivation, and amotivation. They also found that motivation is varied in both quantity and quality (Ahmed & Bruinsma, 2006; Kyoung Um, Corter, & Tatsuoka, 2005; Lepper, Corpus, & Iyengar, 2005; Ryan & Deci, 2000; Shih, 2008; Vansteenkiste, Lens, & Deci, 2006) In intrinsic motivation, behavior is exhibited willingly without any internal or external influences. This type of behavior is mediated with rewards or satisfaction that derives from the behavior itself. Extrinsic motivation has internal or external influences—that is, the behavior is not exhibited for itself, but rather as a means to an end in which consequences are expected as a result of producing the behavior (Vallereand et al., 1992; Vansteenkiste et al., 2006).

According to their review of the literature, Haj Hussein et al. (in press) asserted that extrinsic motivation can be divided into three categories—identified regulation, introjected regulation and external regulation. Extrinsic motivation with identified regulation refers to behavior that is exhibited internally and willingly based on the value and internal causes of the behavior. Extrinsic motivation with introjected regulation refers to behavior that is associated to partial internal influences with externally perceived locus of causality. Extrinsic motivation with external regulation refers to behavior that is exhibited as a result of external influences to obtain a reward or avoid punishment (Cokley, Bernard, Cunningham, & Motoike, 2001; Deci, Vallereand, Pelletier, & Ryan, 1991; Vansteenkiste et al., 2006). Finally, amotivation refers to a lack of motivation—i.e., students are not internally or extrinsically motivated to produce the behavior. They lack the intention and perceive themselves as incompetent (Ryan & Deci, 2000b). Thus, the difference between intrinsic and extrinsic motivation stems from the nature, derivation, and consequences of the behavior.

Based on the above discussion, it seems plausible that both self-efficacy and motivation may play a role in mathematics achievement. The relationship between self-efficacy and mathematics achievement has been well documented in the literature. For example, Langenfeld and Pajares (1993) reported a significant correlation between mathematics self-efficacy and mathematics performance of American undergraduate students. In another similar study, Pajares and Kranzler (1995) reported that American high school students (grades 9, 10, 11, and 12) mathematics self-efficacy had a direct impact on their mathematics anxiety and mathematics performance. In addition, mathematics self-efficacy of gifted and regular eighth grade students from the U.S.A. was investigated. The findings confirmed that mathematics self-efficacy was a significant contributor in predicting their mathematics performance (Pajares, 1996).

In Australia, Nielsen and Moore (2003) found that ninth grade Australian students' mathematics self-efficacy scores were significantly and positively correlated with their mathematics scores from the previous year. Similarly, Nasser and Birenbaum (2005) reported that the mathematics self-efficacy of Palestinian and Jewish eighth grade students had a significant positive impact on their scores on the National Assessment Test in Mathematics.

Ayub (2010) investigated the relationship between intrinsic and extrinsic motivation on the academic performance of 200 college students in India. The findings in this study supported the significance of motivation to academic performance, and hence made recommendations to

University teachers with regard to motivating their students during instruction. These findings conform to earlier findings by Stevens et al., 2004 who reported that mathematics self-efficacy of American ninth grade students was significant in predicting their mathematics performance and motivation.

In another study, Adeyemo and Torubeli (2008) explored the effectiveness of self-efficacy, self-concept, and peer influence in predicting the academic performance (English language, mathematics, biology, and geography) of Nigerian students with ages ranging from 12 to 18 years. These authors found that self-efficacy was the stronger contributor in predicting students' academic achievement.

Regarding gender, Ayub (2010) investigated the relationship between intrinsic and extrinsic motivation on the academic performance of 200 students (100 male; 100 female) and found gender difference ($t=4.324$, $p <.05$) on both motivation and academic performance. Specifically, the findings revealed that females were more intrinsically motivated, whereas, males were more extrinsically motivated. Ayotola and Adedej (2009) also examined the relationship between gender and mathematics achievement, along with several other variables. More than 1,000 students participated in this study. Based on the findings, mathematics self-efficacy was identified as the best predictor of mathematics achievement followed by gender.

Method

The purpose of this study was to determine the extent to which self-efficacy and motivation can predict mathematics achievement across gender and achievement levels. In this study, we attempted to answer the following three research questions with respect to fifth grade students:

1. Can motivation toward mathematics and mathematics self-efficacy predict student mathematics achievement?
2. Is this prediction invariant across gender?
3. Is this prediction invariant across achievement levels?

Participants

This study included a total of 287 fifth grade students (167; 58.2% females; 120; 41.8% males) from the United Arab Emirates (UAE). The sample was selected using the following cluster-sampling method. First, three school districts were randomly selected from the UAE's 10 school districts. The three districts selected were Al Ain, Dubai, and Fujarah. As schools in the UAE are segregated by gender, two male schools and two female schools from each district were randomly selected. Finally, one section of grade 5 students was randomly selected from each school. The average age of the students participating in the study was 10.3 years (SD=1.16).

Instrumentation

Students' motivations toward mathematics were assessed using the *Mathematics Motivation Scale* (MMS) developed by Haj Hussein et al. (in press), based on the theoretical framework of the self-determination theory. This scale was psychometrically assessed on a sample of 1,481 UAE students in grades 4 through 12. The scale consisted of four subscales: Amotivation (9 items), External Regulation (8 items), Introjected Regulation (6 items), and Intrinsic Motivation

(15 items). Internal consistency for this instrument was assessed by computing Cronbach's alpha for each subscale based on the entire sample population. The results ranged from 0.77 to 0.91. As for validity, ten experts in the field reviewed the instrument and approved its final version. The MMS results indicated acceptable levels of content validity, structure validity, and convergent validity.

Two self-efficacy scales in mathematics were also used in the study. These scales (see Alsawaie, et al., 2010) represented two levels of specificity of mathematics problems. The first scale, the *Mathematics Self-Efficacy Task Specific Scale* (TSS) was comprised of 45 items and included multiple choice mathematics problems representing specific task correspondence. This scale included statements about students' confidence in solving mathematics problems in different domains of mathematics—numbers and operations, algebra and patterns, geometry, measurement, and probability and Statistics. The second scale, the *Mathematics Self-Efficacy Category Skill Scale* (CSS), was comprised of 28 items that asked students about their confidence in solving various types of mathematics problems without really stating specific problems.

Reliability and validity scores for the TSS and CSS were calculated using a sample of 645 students who completed 4th grade. Internal consistency and the stability were examined as two parameters of reliability. Internal consistency was measured by computing the correlation coefficients and Cronbach's alpha among the domains and total score (Alsawaie, Haj Hussein, Sartawi, Alghazo, & Tibi, 2010).

The correlation coefficients for each domain of the TSS (numbers and operations, algebra and the correlation coefficients for each domain of the TSS (numbers and operations, algebra and patterns, geometry, measurement, and probability and statistics) ranged from 0.436 to 0.697; the correlations coefficients between each of the domains and the total score ranged from 0.736 to 0.927. Cronbach's Alpha was calculated for each domain of the TSS (Table 1). The results indicated that the TSS has acceptable levels of internal consistency as the coefficients ranged between 0.660 and 0.927.

Table 1
Internal Consistency Coefficients (Cronbach's Alpha) of the TSS Domains

Domain	Number of Items	N	Alpha Coefficient
Numbers and Operations	17	604	0.818
Algebra and Patterns	6	615	0.846
Geometry	7	632	0.660
Measurement	9	637	0.686
Probability and Statistics	6	628	0.755
Total Score	45	574	0.927

The correlation coefficients among CSS domains (numbers and operations, algebra and patterns, geometry, measurement, and probability and statistics) ranged from 0.372 to 0.579; the correlation coefficients between each domain and the total score ranged from 0.727 to 0.801.

Cronbach's Alpha was calculated for each domain of the CSS (Table 2). The results indicate that the TSS has acceptable levels of internal consistency as the coefficients ranged between 0.625 and 0.919. The results indicated that the CSS also has acceptable levels of internal consistency.

Table 2
Internal Consistency Coefficients (Cronbach's Alpha) of the CSS Domains

Domain	Number of Items	N	Alpha Coefficient
Numbers and Operations	8	578	0.827
Algebra and Patterns	4	609	0.627
Geometry	7	599	0.738
Measurement	5	610	0.625
Probability and Statistics	4	630	0.849
Total Score	28	524	0.919

Results

Prior to the statistical analyses, all variables in the data set were screened for outliers or extreme values. No outliers or extreme variables were identified. The data sets were also screened for missing values. Most of the variables had very few missing cases. The highest percentage of missing data was around 6%, while many variables had no missing data. Because all variables were used in calculating the multiple regression, include all participants' responses in the data analysis, variables with missing data were replaced using the series mean.

Based on the previous year final grade in mathematics, students were classified into three ability groups—a low ability group (students with mathematics achievement in the lowest 33%), a high ability group (students with mathematics achievement in the highest 33%), and a medium ability group (all of the remaining students). The first analysis calculated the mean, standard deviation, and range of achievement in mathematics for the sample as a whole, for gender, and achievement group. The results of this analysis (see Table 3) gives an idea about the range of achievement scores, how spread out they are, how many students were in each group, and how each group differed.

Table 3
Mathematics Achievement Scores for Sample Population
Showing Gender and Achievement Group

	N	Mean	SD	Range
Sample	287	76.51	15.50	72.00
Males	120	71.70	15.93	72.00
Females	167	79.97	14.26	67.00
Low Ability	93	63.00	13.60	63.00
Medium Ability	93	77.25	11.69	50.00
High Ability	101	87.64	10.67	48.00

Table 4 shows the means and standard deviations for students' responses on the mathematics motivation and self-efficacy scales reported in relation to gender.

Table 4

Means and Standard Deviations for Responses on Both Mathematics Scales by Gender

Gender		Mathematics Motivation Scale: Amotivation	External Regulation	Introjected Regulation	Intrinsic Motivation	Mathematics Self-Efficacy Scale: Task Specific	Domain Specific
Females	Mean	16.64	22.22	20.80	49.17	143.48	60.38
(n = 167)	SD	7.25	5.31	3.27	6.36	19.97	10.30
Males	Mean	20.39	23.02	19.81	47.54	141.24	57.48
(n =120)	SD	7.29	5.15	3.20	6.72	23.20	11.75

Responses of the two genders were not similar on most of the subscales. However, these differences were practically small except for the Amotivation subscale where a noticeable difference between males and females could be observed. This difference is also statistically significant as assessed by independent t-test ($t = -4.30$, (males = 102, females = 167), $p < .01$). The difference between genders on Amotivation is not so surprising in the context of the UAE. Females in the country are usually more motivated than males for different social and economic reasons.

Table 5 presents the means and standard deviations for students' responses on the mathematics motivation and self-efficacy scales in relation to achievement group.

Table 5

Means and Standard Deviations for Responses on Both Mathematics Scales by Achievement level

Ability Group		Mathematics Motivation Scale: Amotivation	External Regulation	Introjected Regulation	Intrinsic Motivation	Mathematics Self-Efficacy Scale: Task-Specific	Domain-Specific
Low Ability	Mean	20.80	23.13	20.03	47.16	136.75	58.21
(n = 93)	SD	7.45	4.77	3.52	6.21	22.43	10.44
Medium Ability	Mean	18.96	23.19	20.14	48.21	141.75	58.46
(n= 93)	SD	7.33	4.98	3.16	6.79	21.49	11.98
High Ability	Mean	15.12	21.41	20.94	49.96	148.60	60.71
(n=101)	SD	6.60	5.76	3.09	6.39	18.68	10.50

To estimate differences in responses across achievement level, an ANOVA test was performed for each subscale. The results indicated that the differences were statistically significant for all subscales except for Domain Specific and Introjected Regulation. Table 6 summarizes these results.

Table 6

ANOVA Results for Mathematics Self-Efficacy and Motivation Subscales Across Achievement Level

			Sum of Squares	Mean Squares	df	F	Sig.	Eta2
Mathematics Self-Efficacy Subscales	Task Specific	Between Groups	6885.083	3442.541	2	7.903	.000	.05
		Within Groups	123711.336	435.603	284			
		Total	130596.419					
	Domain Specific	Between Groups	372.626	186.313	2	1.545	.215	.01
		Within Groups	34243.015	120.574	284			
		Total	34615.642					
Mathematics Motivation Subscales	Amotivation	Between Groups	1641.323	820.661	2	16.178	.000	.10
		Within Groups	14406.746	50.728	284			
		Total	16048.06					
	External-Regulations	Between Groups	201.113	100.556	2	3.712	.026	.03
		Within Groups	7692.839	27.087	284			
		Total	7893.951					
	Introjected Regulation	Between Groups	48.288	24.144	2	2.275	.105	.02
		Within Groups	3014.612	10.615	284			
		Total	3062.900					
	Intrinsic Motivtion	Between Groups	391.183	195.592	2	4.676	.010	.03
		Within Groups	11878.535	41.826	284			
		Total	12269.718					

The results of ANOVA tests above indicated that there is a significant difference among the three groups of achievement for four subscales: Task Specific, Amotivation, External Regulation, and Intrinsic Motivation. However, these results did not show which groups differ. Therefore, a post hoc analysis was conducted for each of these four scales on the three achievement groups. Table 7 shows the achievement groups that have significant differences.

Table 7
Post Hoc Analysis for Responses on Both Mathematics Scales by Achievement Level

	Domain	Achievement Groups	Mean Difference	Significance Level
Mathematics Self-Efficacy Scale	Task Specific	Low Ability and High Ability	-11.85	P < .001
Mathematics Motivation Scale	Amotivation	Low Ability and High Ability	5.68	P < .001
		Medium Ability and High Ability	3.84	P < .01
	External Regulation	Medium Ability and High Ability	1.78	P < .05
	Intrinsic Motivation	Low Ability and High Ability	2.80	P < .01

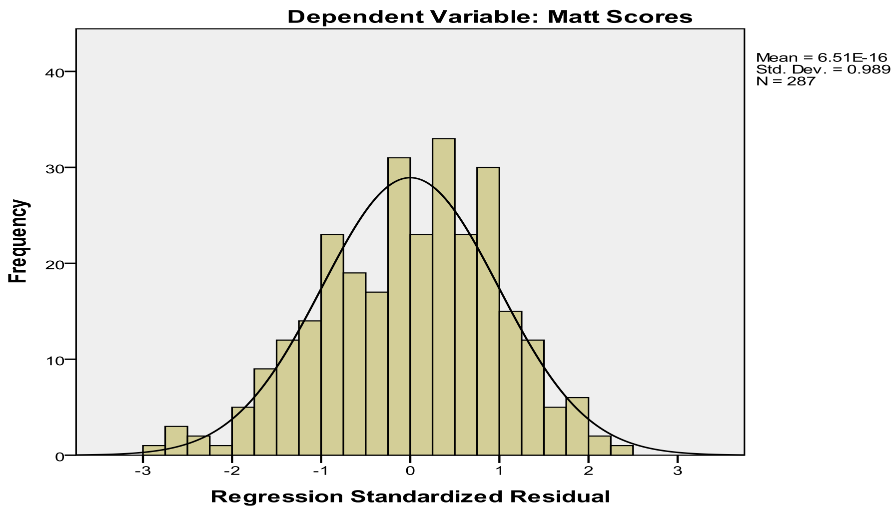
Predicting Math Achievement

Six subscales were used to predict the fifth grade students' achievement in mathematics. To estimate the level of predication, a multiple regression was conducted using the six subscales as independent variables (predictors) and students' achievement in mathematics as the dependent variable. Multiple regression analysis relies statistically on several assumptions that should be checked before running the test. These assumptions include: independence of observations, normality, linearity, and homoscedasticity. The independence of observations means independent responding to the questionnaires. This assumption was met because all participating students answered the questionnaires used in this study independently in the classroom environment, and under the supervision of their teachers. As for normality assumption, normality in multiple regression means that the differences between the predicted and observed values (called residuals) are normally distributed around the dependent variable scores. This assumption was checked through drawing a histogram (see Graph 1), which showed that the residuals were normally distributed around the math scores.

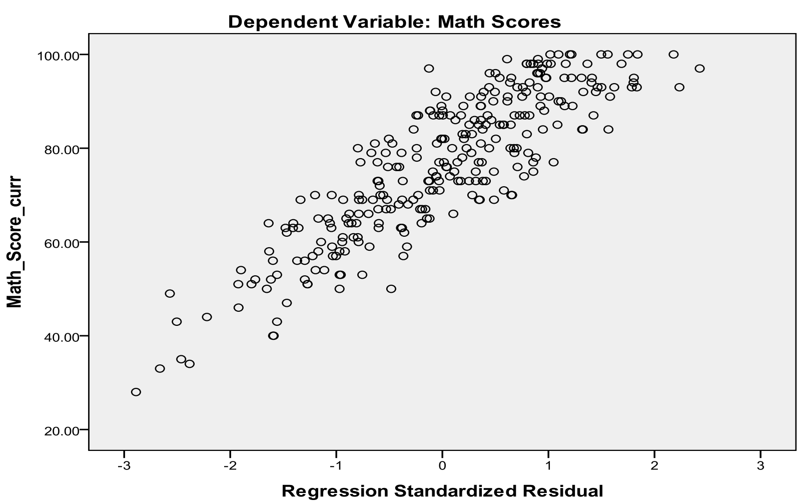
The linearity assumption means that there is a linear relationship between the set of the independent variables and the dependent variable. This assumption was assessed through plot the regression standardized residuals and the dependent variable (math scores) as shown in Graph 2. The assumption was also met as the graph showed no curvilinear relationship.

The homoscedasticity assumption means that the variance of errors is the same (constant) across all levels of the independent variables. This assumption was also graphically checked (see Graph 3) through a plot of regression standardized residuals and regression standardized predicted values. If the values are randomly distributed around the value 0 of each axis (as it is in this case) then the assumption is met. In addition to these four important assumptions in multiple regression, the six predictor variables as well as the dependent variable should be metric (measure on at least interval level). This assumption was also met here.

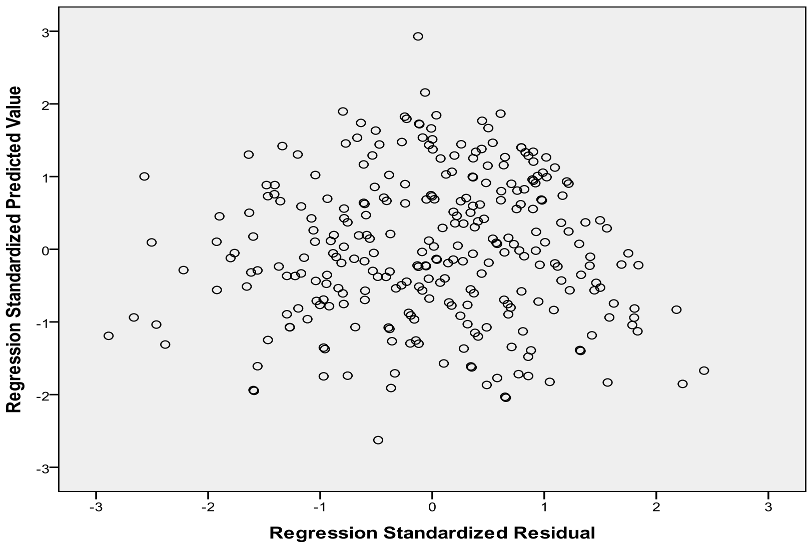
Graph 1
Normality Assumption



Graph 2
Linearity Assumption



Graph 3
Homoscedasticity Assumption



The results in the multiple regression analysis output was statistically significant (f = 7.1, p <.01) which indicated that the model is appropriate to predict the dependent variable (mathematics achievement). The results also indicated that the multiple correlation coefficient R was .66 and that the six predictors were able to explain together 32% of the variance in mathematics achievement. The performance of each predictor was also assessed in the multiple regression analysis. Table 8 displays Beta standardized coefficients and t-test results, which could be used to assess the performance of each predictor in the multiple regression analysis.

Table 8
Performance of the Six Subscales (Predictors) of Mathematics Self-Efficacy and Motivation Subscales in Predicting Mathematics Achievement

	Variable	Standardized Beta coefficient	t-test	Significance level
Mathematics Self-Efficacy Scale	Task Specific	.378	3.262	.002
	Domain Specific	-.212	-1.871	.065
Mathematics Motivation Scale	Amotivation	-.093	-.921	.360
	External Regulation	-.358	-3.014	.003
	Introjected Regulation	.243	1.995	.049
	Intrinsic Regulation	.243	2.052	.043

The results shown in Table 8 revealed that except Amotivation, the other five predictors contributed well in the prediction of mathematics achievement. The t-test values were statistically significant for Task Specific, External Regulation, Introjected Regulation, and Intrinsic Regulation. The Domain Specific was not statistically significant (p =.065). According to these results, the best predictor was Task Specific, then External Regulation, then Intrinsic Regulation, and the least one was Amotivation.

In order to assess the prediction of students' mathematics achievement across gender, the multiple regression analysis was conducted on each gender separately. ANOVA results were significant ($F = 6.98$, $p < .01$ for females and $F = 7.99$, $p < .01$ for males) for both genders, which indicated that the model is statistically appropriate. The multiple correlation coefficient R for females was found to be .46 and 21% of the variance in mathematics achievement was explained by the six predictors together. For the males, the multiple correlations R was .55 and 30% of variance in achievement was explained by the same predictors. This means that the performance of the predictors for the male group was better than that for females. Moreover, how each predictor affected in the total prediction was different between the two gender groups. The results of the performance of each predictor on each group appear in Table 9.

Table 9
Performance of the Six Subscales (Predictors) of Mathematics Self-Efficacy and Motivation Subscales in Predicting Mathematics Achievement Across Gender

		Females			Males		
	Variable	Standardized *Beta* coefficient	*t*-test	Sig. level	Standardized *Beta* coefficient	*t*-test	Sig. level
Mathematics Self-Efficacy Scale	Task Specific	.288	2.766	.006	.342	3.452	.001
	Domain Specific	-.106	-1.043	.299	-.053	-.552	.582
Mathematics Motivation Scale	Amotivation	-.036	-.445	.657	-.448	-4.677	.000
	External Regulation	-.305	-3.528	.001	.032	.303	.762
	Introjected Regulation	.135	1.440	.152	-.147	-1.410	.161
	Intrinsic Regulation	.230	2.419	.017	.212	1.985	.050

For female students, three variables (Domain Specific, Amotivation, and Introjected Regulation) do not have significant t-value. This means that these are not good predictors of mathematics achievement. On the other hand, the best three predictors were External Regulation then Task Specific, and then Intrinsic Regulation in the same order. As for male students, External Regulation was the least important predictor then Domain Specific and Introjected Regulation. The best predictors for males were Amotivation (negatively), Task-Specific, and then Intrinsic Regulation in the same order.

The third goal of this study was to assess the prediction of mathematics achievement by motivation and math efficacy across achievement levels. Three achievement levels were identified and used for comparison. A multiple regression analysis was conducted on each achievement level. Table 10 summarizes the multiple regression results for the three achievement levels.

Table 10

Multiple Regression Results cross Achievement levels

Achievement Level	R	R square	F	Sig. level
Low Achievement Level	.43	.18	3.167	.007
Medium Achievement Level	.21	.05	.627	.67
High Achievement Level	.46	.21	4.215	.001

The results above indicated that the achievement level influenced the prediction of mathematics achievement. While the model predicted around 20% of the variance of math achievement for low and high ability students, the model was not statistically appropriate for the medium ability students. The performance of the six predictors also varies according to the achievement level (see Table 11).

Table 11

Performance of the Six Subscales (Predictors) of Mathematics Self-Efficacy and Motivation Subscales in Predicting Mathematics Achievement Across Achievement levels

		Mathematics Self-Efficacy Scale		Mathematics Motivation Scale			
		Task Specific	Domain Specific	Amotivation	External Regulation	Introjected Regulation	Intrinsic Regulation
Low Ability	Standardized *Beta* Coefficient	.206	.055	-.178	-.267	.124	.193
	t-test	1.623	.426	-1.507	-2.063	1.001	1.518
	Significance Level	.108	.671	.135	.042	.320	.133
Medium Ability	Standardized *Beta* Coefficient	-.026	.163	-.100	-.116	-.036	.118
	t-test	-.161	.994	-.821	-.801	-.224	.751
	Significance Level	.872	.323	.414	.426	.823	.455

Table 11 Cont'd

		Mathematics Self-Efficacy Scale		Mathematics Motivation Scale			
		Task Specific	Domain Specific	Amotivation	External Regulation	Introjected Regulation	Intrinsic Regulation
High Ability	Standardized *Beta* Coefficient	.364	-.115	-.084	-.146	.076	.206
	t-test	3.266	-1.023	-.772	-1.324	.587	1.626
	Significance Level	.002	.309	.442	.189	.559	.107

As can be observed from Table 11, the performance of the six predictors was different across the three achievement levels. For the low ability group, only External Regulation was statistically significant predictor. The other five variables were not good predictor of students' achievement in mathematics. With respect to the medium ability group, the model was not statistically appropriate, and no variable was a significant predictor. Finally, the Task Specific was the only significant predictor for the high ability students.

Discussion

The results of ANOVA tests above indicated that there is a significant difference among the three groups of achievement for four subscales: Task Specific, Amotivation, External Regulation, and Intrinsic Motivation. These results can be explained according to the self-determination theory (SDT). According to SDT, external regulation is the classic case of extrinsic motivation in which rewards and punishment play a big role in individual's behavior (Deci & Ryan, 2000). Therefore, it is not surprising that high achievers in mathematics would be less likely to be externally regulated to study mathematics. These students are usually more intrinsically motivated.

Amotivation, according to the SDT, is the passive acting or the lack of intention for acting. Ryan and Deci (2000a, 2000b, 2002) suggest two possible reasons for that. The first is not seeing the value of activity and the second is the lack of feeling competent. With this understanding, it is logical to find that higher achieving students are motivated.

According to SDT, people are intrinsically motivated to do an activity because they find it interesting and enjoyable. Specifically, "intrinsic motivation is defined as the doing of an activity for its inherent satisfactions rather than for some separable consequences" (Ryan & Deci, 2000a, p. 56). Based on this definition, higher achieving students are more likely to be more intrinsically motivated than other students.

With introjected regulation, people perform behaviors under the pressure of others. They behave well in order for others to respect them, and they avoid bad behavior to avoid shame. It seems from the results of the study that students are equally regulated by introjects regardless of their achievement level. Students' scores on this domain ranged between 20.03 and 20.94 out of 24 indicating that all students are highly regulated by introjects. The conservative culture of the UAE and the Arabic world in general may have influenced these results. In this culture, children respect their parents and seek their respect. And since failure is considered a shame, children may put effort into study just to avoid such shame. This is true regardless of the achievement level of these children.

Unlike task specific, in category specific students are asked to evaluate their confidence in answering problems in certain domains without specifying these problems. Students -regardless of their achievement levels- might think that they are able to solve the problems. In task specific however, specific problems are presented. Therefore, high achievers are more likely to judge themselves as being able to solve the problems.

The multiple regression analysis indicated that the six predictors (Task Specific, Domain Specific, Amotivation, External Regulation, Introjected Regulation, and Intrinsic Regulation) were able to explain together 32% of the variance in mathematics achievement. This is a high percentage given the fact that students' achievement is generally affected by many variables. Moreover, many students see mathematics as difficult, complex, and as an abstract topic (Ernest, 2004), and many variables such as motivation to learn mathematics, mathematics anxiety, and attitudes toward mathematics are usually affecting achievement in mathematics more than other disciplines.

As for the performance of each predictor, it is expected that Task Specific self-efficacy will be a good predictor of mathematics achievement because students who are more confident in their capabilities tend to work harder, solve problems more efficiently, monitor their progress regularly and hence, achieve better than their peers who do not have high self-efficacy. Many previous studies showed the predictive value of self-efficacy beliefs and students' academic achievement (e.g., Brown & Lent, 2006; Pajares & Miller, 1994; Pajares & Urdan, 2006; Stevens, Olivarez, Lan, & Tallent-Runnels, 2004).

As for motivation, these results agree with some previous research and disagree with others. Gronlick and Ryan (1987) found that external, introjected, and identified regulation and intrinsic motivation were related to better conceptual learning. In their experimental study, the authors assessed the learning of 91 fifth graders under different conditions; two directed conditions (controlling & non-controlling) and contrasted with a spontaneous-learning context. Results showed that both the non-directed and the non-controlling directed-learning sets resulted in greater interest and conceptual learning of texts as opposed to rote learning. The authors explained the positive outcomes of students' learning in terms of the role of autonomy in learning and development as the internal locus of causality. Vallerand, Blais, Brieri, and Pelletier (as cited in Vallerand & Bissonnette, 1992) found that intrinsic motivation related positively to educational outcomes at college students; both external and introjected regulations were either negatively related or not related to educational outcomes; amotivation was strongly negatively related to educational outcomes. Motivational beliefs were found to have a considerable influence on Turkish students' mathematics achievement (Ozturk, Bulut, & Koc, 2007). Further, Ayub (2010) found that intrinsic and extrinsic motivation and academic performance were positively correlated ($r = .563$; $n=200$; $p < .000$).

When gender is considered, three variables (Domain Specific, Amotivation, and Introjected Regulation) were not good predictors of mathematics achievement. On the other hand, the best three predictors were External Regulation, Task Specific, and Intrinsic Regulation. As for male students, External Regulation was the least important predictor then Domain Specific and Introjected Regulation. The best predictors for males were Amotivation (negatively), Task-Specific, and then Intrinsic Regulation in the same order.

These results reveal two important differences between genders in the UAE. First, Amotivation plays an important role in males' lack of achievement in mathematics, and second, External Regulation is more predictive with females than males. Previous research seems to offer an explanation to these differences. It is suggested that females tend to attribute their mathematics successes to external factors and to effort and their failures to their own lack of ability, whereas boys tend to ascribe the causes of their mathematics successes to internal factors and their failures to external factors (Campbell & Hackett, 1986; Leung, Maehr, & Harnish, 1996; Swim & Sana, 1996; Wolleat, Pedro, Becker, & Fennema, 1980).

With respect to achievement, the performance of the six predictors was different across the three achievement levels. For the low ability group, only External Regulation was a statistically significant predictor. This result indicates that low achieving students usually need support and encouragement from outsiders to work toward achievement in mathematics. Those outsiders are usually teachers and parents. In the medium ability group, the model was not statistically appropriate and no variable was a significant predictor. Finally, the Task Specific was the only significant predictor for the high ability students. This is an expected result actually since high achievers are better able to judge their ability in solving specific mathematics problem. Therefore, their scores on the task specific self-efficacy scale should highly correlate with their mathematics achievement.

Conclusion

In conclusion, the study examined predicting students' math achievement through motivation toward math (Amotivation, External Regulation, Introjected Regulation, and Intrinsic Regulation) and math self-efficacy (Task Specific and Domain Specific). The multiple regression model showed that the six predictors were able to explain together high percentage (32%) of the variance of mathematics achievement. Also the results indicated that the best three predictors were Task Specific, External Regulation, and Intrinsic Regulation. When conducting the regression model across gender, the results showed that 30% of the variance in math achievement was explained by the six predictors for the males group while only 21% of the variance was explained for the females group. Also the rank order of the best predictors was different between males and females. Finally, the regression model differed also across achievement level. Specifically, while the model predicted around 20% of the variance of math achievement for each of the low and high ability students, the model was not statistically appropriate for the medium ability students. Additionally, the performance of the six predictors varies according to the achievement level.

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Insurance and Mathematics: Developing Democratic Citizenship Through Interdisciplinary Approaches to Contemporary Issues

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Insurance is an interesting interdisciplinary topic that can offer generative meaning and relevance for students. By adapting real life examples and authentic simulations, mathematical concepts can be applied to insurance-related social studies issues and content. This article explores ways to teach insurance and related mathematical concepts to middle school students using an interdisciplinary approach and it demonstrates various concomitant benefits in teaching mathematics with the concept of insurance by connecting it to important democratic citizenship dispositions such as civic participation, critical thinking, interpersonal skills, and knowledge of political activity. The ultimate goal of this interdisciplinary approach is to develop students' ability to make informed and reasoned decisions as current and future consumer-citizens.

Keywords: mathematics, social studies, insurance, citizenship education

Social studies education is one of the primary vehicles for educating and preparing future citizens who can actively participate in and promote democratic beliefs and actions. Yet, a growing number of recent studies (Barton & Levstik, 2004; Doppen, Misco, & Patterson, 2008; Heafner, Lipscomb, & Rock, 2006; Misco, Patterson, & Doppen, 2011; Rock et al., 2006; Torney-Purta, Lehman, Oswald, & Schulz, 2001; VanFossen, 2005) have suggested that social studies education is more frequently marginalized than other subject areas within the context of high-stakes testing that often privileges reading, writing, and mathematics.

Teachers face numerous challenges in offering relevant and meaningful social studies for their students. This is due in part to the conflicting cultures of education that are often encountered by social studies teachers. Many teachers tend to experience a discrepancy between what they learned in their university's teacher education program and what they teach in public schools. In short, social studies teachers frequently consider the idealistic approaches of the university that do not always align with the reality in classrooms where test-driven teaching plans and strategies are oftentimes emphasized (Apple, 2001; Au, 2007; Darling-Hammond, 2010; Leming, 1989). Due to this reason, many teachers simply offer textbook-based teaching that focuses on recitation and memorization with few opportunities for deliberation, reflection, reasoning, and critical thinking (Kahne, Rodriquez, Smith, & Thiede, 2000). As a result, students oftentimes perceive historical content as detached from and irreverent to their current interests, concerns, and problems, and therefore consistently devalue social studies over many other subjects (Chiodo & Byford, 2004; Schug, Todd, & Berry, 1984).

Given these challenges, this article looks to mathematics, which enjoys a privileged place in the macrocurriculum, to broach social studies. Specifically, this article explores how to teach mathematics to middle school students in relation to insurance, which is an interdisciplinary topic that can offer generative meaning and relevance for students. By adapting real life examples of insurance, teachers can utilize mathematical concepts and apply them to social studies by aiming at students' informed and reasoned decision-making process. Furthermore, the practice of insuring and the American institution of insurance represent a contemporary controversial issue within the socio-political contexts of post-Katrina and the ongoing health care reform debates. This article highlights various concomitant benefits in teaching mathematics with the concept of insurance by connecting it to important democratic citizenship dispositions, such as civic participation, critical thinking, interpersonal skills, and knowledge of political activity.

Teacher Education and Interdisciplinary Approaches

Interdisciplinary approaches to teaching and learning broaden student knowledge of history and culture while increasing content understanding, raising test scores, enhancing critical thinking, enhancing ownership in the learning process, and developing life-long learning skills and dispositions (Duerr, 2008; Jones, 2009; Taylor, 2008). In teacher education, employing interdisciplinary approaches and epistemologies help prepare future teachers for 21st century global and local issues that require different kinds of learning (Gal, 2011). Teacher education faces a timely charge to reorganize disciplines through coordinated interdisciplinary education for all students (Kaufman & Brooks, 1996) and interdisciplinary teacher education focuses on new approaches to solve problems, promote dialogue, cinch together the interests of diverse stakeholders, and synthesize heretofore disparate ways of knowing how to prepare future teachers to take interdisciplinary approaches in their future classrooms (Klein, 2002; LaFever, 2008).

Social studies is a unique area of teacher education, one that is necessarily dependent upon an interdisciplinary curricular approach. Academic disciplines housed within social studies (e.g., history, economics, geography, political science, sociology, anthropology, psychology, and philosophy) are not only interrelated, but are most potent for democratic citizenship education when they are unified toward a specific problem or issue. In isolation, these disciplines offer the potential for epistemological pathways to understanding the world and the nature of different forms of knowledge. But in their unity, and directed toward student understanding of relevant, value-based, and normative issues, they contain the content necessary for students to make informed and reasoned decisions as democratic citizens (NCSS, 2010). Joining these disciplines with mathematics further expands the extent to which citizens are able to grapple and respond to real-life concerns and work toward developing a more just and sustainable society for all of its members.

Insurance and Social Studies from a Western Socio-Historical Perspective

The concept of insurance originated within the merchant guild of long-distance marine trade in medieval Europe (Gelderblom & Grafe, 2010; Supple, 1970). Later, fire insurance became prominent, most notably after the Great London Fire of 1666 (Nelli, 1976). Eventually, the underwriting of ships through analysis of variables became systematized at Lloyd's Coffee House, including descriptions of property, crew, and amount of insurance needed (Vance, 1911).

In the United States, the first insurance office opened near Penn's Landing in 1721. As the development of trade unfolded, especially during the 18th Century, being able to assuage risk ultimately encouraged investment, trade, commerce, and other acts of interchange that would normally require an extraordinarily high tolerance for catastrophe (Wertheimer, 2006). By no longer having to worry about being overleveraged and exposed to calamitous outcomes, entrepreneurs and citizens alike began to take calculated risks that enabled the building of factories, purchase of homes, and shipment of goods. Today risk can be mitigated for innumerable concerns, such as mortgages, crops, accidental death, long-term care, floods, travel, wages, disability, and scores of other possible phenomena.

Discussions about insurance are often focused mostly on one purpose—protection of individual property. Even though such protection is a major function of insurance in contemporary society, the insurance system rarely had a singular purpose. For instance, merchant guilds initially aimed to help each other in case of unexpected natural calamities and "personal hardship" among merchants (Gelderblom & Grafe, 2010, p. 6). In addition, insurance had to do more with strong social ties and relationships, which led the merchants to use it for collective protection (Gelderblom & Grafe, 2010). Insurance allows for an extension of Lockean ideals, most notably as a means to safeguarding property (Burke, 1995). In this sense, both insurance and the government work to secure individual rights, liberties, and property. As our democratic government began to offer public forms of insurance, the normative question arose concerning the onus of responsibility—the government or the individual. Just as a government could not deprive citizens of personal property (as later embodied in our constitution), neither could disaster, theft, and the vagaries of nascent globalization. Specially, the 5th Amendment to the U.S. Constitution guarantees that citizens will not be "deprived of life, liberty, or property, without due process of law; nor shall private property be taken for public use without just compensation." From this perspective, insurance is an extension of that guarantee within a more economic and public sphere.

Another example involves differentiating fire insurance and catastrophic relief. Originally, the people subscribing to insurance enjoyed the benefits of fire extinguishment and later replacement of loss, whereas those who did not have insurance ran the risk of losing property. Given the risk associated with the fire of one affecting many, it made sense to guarantee the extinguishment component of fire insurance to all members of a community through fire departments. As it moved into a socially shared responsibility sphere and usufruct, insurance entered a governmental system of taxation and spending. When communities are faced with a catastrophic flood, for which few may hold insurance, the government might call forth a state of emergency, thereby offering public resources to remedy a large-scale disaster, as in the case of Hurricane Katrina.

Because the concept of insurance requires planning preceding the event, to cover a risk *before the fact*, the issuance of insurance is also connected to economic equity and justice. For individuals living in poverty stricken communities who cannot afford to assuage risk by purchasing insurance (or who would choose not to procure the proper insurances for their property with contempt for nature), they would be unprepared for a disaster. People without insurance would simply endure the pains of loss regardless of lacking the resources to do so or the reflection on possible consequences. If we only consider insurance in light of the concept of deservedness, we would neglect one of the important purposes that insurance originally had—i.e., establishing a secure community and society where every citizen can be protected through mutual help. In one sense, ensuring each individual's security is situated both in public and private domains where a larger network of others taking on risk, especially those who did not afford to plan, is distinct from distributive justice models seeking to secure losses of individuals who had an a priori plan for risk.

The Mathematics of Insurance and Actuarial Science

The history and normative judgments about insurance can provide an opportunity for students to learn about the mathematics that underlies actuarial science. Teaching the concept of insurance in integrated lessons with mathematics and social studies brings a real world situation into the classroom, which can help students become more aware of how these combined subjects can relate to their lives. In addition to developing mathematical skills, this integrated teaching encourages students to become wise consumers and decision makers.

Teaching about insurance can effectively be connected to mathematical concepts by estimating actual insurance premium rates. Actuaries use mathematics, statistics, and tables (based on previous years data of a particular phenomenon) to make predictions about risk analysis and the financial costs of risks. However, constructing and using tables requires the ability to recognize and analyze trends for insurance firms to be profitable. Insurance involves a contract:

> . . . by the insurer to indemnify the insured against loss by the casualty defined in the policy. The insured pays a sum certain for protection against an event, which may or may not occur during the life of the policy. The premium is calculated with respect to the average chance that the given event will ever occur. (Abbot, 1910, p. 119)

Actuarial science involves the analysis of risk and its financial outcomes. By employing mathematics, financial theory, and statistics, actuarial scientists study the uncertainty involved in future events (Purdue University, 2012).

To calculate an insurance premium rate, an actuarial price can be modeled with three values—E(S), k, and R. The premium rate is the sum of these three values, all of which do not include reference to investments. The premium is described in Equation 1 (see below) by the following actuarial price-setting formula derived by Briys and de Varenne (2001):

$$\mathbf{P} = E(S) + k + R$$

In this equation, **P** represents the premium, or how much is being paid by the insured. Meanwhile, the function **E(S)** represents the mathematical expectation of claims for which premiums increase as expected claims increase. This part of the equation assures that increased costs to the insurance company are passed along to the consumer(s). The **k** denotes ongoing company running costs (otherwise known as overhead) and **R** is a risk premium, which is the payment for coverage of unforeseen deviations (spikes) in the claims amount (Briys & de Varenne, 2001). As a safety factor, the **R** also insures the company's base profits to protect the company from massive losses when claim payouts are incurred.

Simulation Examples

To help students understand the mathematics behind insurance, we conceptualized the following simulations as a framework for developing multiple lessons with an interdisciplinary focus linking mathematics and social studies.

Example 1

This simulation describes how "Pencil Insurance" may work and how it might be included in a probability unit in mathematics or a justice-oriented unit in social studies. To begin, ask students to: (1) keep a record of how many times two fellow classmates forgot to bring a pen or pencil to classes throughout the day, and (2) record the specific class in which the pencil was missing. This should be done over several days, perhaps three to five days to establish a baseline. Using the data the students gathered, create a reference table (see Table 1 which shows "sample data" denoting the total occurrences of a forgotten pencil by class into probabilities).

Table 1

Sample Data for Probability of Forgetting a Pen/Pencil

	# of Times Forgotten					
Class Period	1	2	3	4	5	6
1	0.50	0.00	0.00	0.00	0.00	0.00
2	0.35	0.65	0.00	0.00	0.00	0.00
3	0.32	0.50	0.70	0.00	0.00	0.00
4	0.27	0.46	0.60	0.75	0.00	0.00
5	0.23	0.40	0.50	0.70	0.80	0.00
6	0.20	0.38	0.40	0.55	0.80	0.99

Note: The values are probability values for students forgetting a writing utensil based on the total observations for all students

This table shows individual class periods, but could also be based on days of the week. Formulating a table such as this provides an opportunity for students to broach issues about probability and chance. Students could calculate the probability for which their designated classmate will forget his/her pencil for each class (based on the units of your table) using the formula in Equation 2:

$$\mathbf{P(\textit{Student})} = \frac{\text{Total times student does not have pencil}}{\text{Total classes observed}}$$

Similarly, the students can calculate the chance of any one of their classmates forgetting a pencil using Equation 3:

$$\mathbf{P(\textit{Class})} = \frac{\text{Total times any student does not have pencil}}{\text{Total classes observed}}$$

In Equation 1, a student's **P** or premium (their cost for the use of a pencil) would increase as the number of pencils that they forget increases. Economically, it costs much more to insure a student who forgets a large number of pencils, so in practice, they must pay more. The student's risk could be evaluated against the class standard, which is calculated in Equation 3.

In reality, students are creating a comparison between themselves and the class, akin to the mathematical expectation of claims and safety factor as shown in Equation 1. In this case, "higher risk" students, who forget to bring a writing utensil (i.e., pencil or pen) to class more often than the average, may be required to pay a higher premium to insure that they will not be without a pencil, as there is a greater probability that they will forget.

For this activity, position students to work in small groups to look for trends in the data they collect and have them create their own insurance plans. One suggestion is that all students pay a penny per class for insurance, which would provide a pen or pencil on loan for the class period. However, students who have a higher risk of forgetting their pencil will have to pay two pennies per class. The students could be given the option to consider if rates should increase after a student forgets their pencil or if they should have a fixed rate. As a class, discuss the insurance plan of each group and whether everyone thinks the plans are fair for everyone or only some. Also, consider whether pencil insurance should be a private enterprise run by a group of entrepreneurial students or if the risk of not having a writing utensil is so profound that the government (i.e., the classroom teacher) should provide pencil insurance for all students without cost.

Example 2

This simulation addresses the societal problems of using insurance inappropriately, whereby the risk that it is insured against is an inevitable outcome for all. In these situations, rather than employing or retaining insurance, students are asked to ponder the extent to which the public should provide risk mitigation for all in the form of usufruct. For example, all human beings are physically fallible and will, at some point, require medical treatment. The application of insurance to this particular phenomenon might therefore seem misguided given its inevitability. Rather than generationally engage in a national debate about health insurance and the government's role in providing insurance, perhaps we should accept the idea of free medical treatment for all, paid for by all citizens through taxation.

Because some citizens require medical treatment more often and at a greater expense than others because of lifestyle choices, some citizens may argue that they are being penalized financially for the poor choices of other citizens, whereas others may suggest that certain medical procedures are not needed due to cost, remaining life expectancy of the patient, among other variables. In short, providing treatment to all through shared responsibility seems appealing given the *purpose* of insurance, but given the many variables affecting each individual and their cost to society, it may unfairly burden those who make responsible health decisions.

In response to this normative policy problem, students can apply the lessons learned in the pencil insurance simulation to a new arrangement of variables. First, ask students to imagine a society of which they are not currently a member and consider what the most just system would be relative to health treatment and insurance. Similar to the "veil of ignorance" (Rawls, 1971), students are asked to consider justice and moral issues independent of their present station in life. Using the instructional strategy "powers of two," organize students in pairs and ask them to agree upon a system that should be in place and the ways in which the system should provide the greatest degree of justice, based upon whichever variant they choose (e.g., distributive, procedural, equalitarian). Keep amassing pairs of students into groups of four, then eight, and ultimately the whole class, while each time requiring a compromise in terms of what the just system should be for all class members.

Afterwards, construct a series of biographical cards indicating a wide variation of life choices, habits, genetic ailments, occupations, family history of disease, and other variables. These cards may also include the expected number of doctor and hospital visits over a lifetime, life expectancy, injuries, and other relevant material. Each student will take on the fictitious role and reconcile it with the negotiated system. Ask pairs of students to reflect and share their perspectives about the extent to which the system offered a just solution to their medical needs and whether it appropriately balances individual freedom with social responsibility.

Benefits of Teaching Mathematics and Social Studies with the Concept of Insurance

The benefits in teaching mathematics and social studies with the concept of insurance are numerous. By coupling mathematics and insurance, students can recognize and come to understand important democratic citizenship dispositions such as civic participation, critical thinking, interpersonal skills, and knowledge of political activity. In addition, broaching this relevant, normative, and controversial topic helps develop core democratic dispositions (Misco & Shiveley, 2010).

The three categories of core democratic dispositions, which are open-mindedness, wholeheartedness, and responsibility (see Table 2), resonate with student understanding of insurance from mathematical and social studies perspectives. For example, rather than simply accepting prima facie ideological claims about insurance in the media, students can marshal their understanding of these concepts to contemporary and novel examples with greater dissent, curiosity, and tolerance. Again, as a result of understanding insurance in a citizenship context, students will have the occasion to employ dispositions related to wholeheartedness, including individual responsibility for insuring themselves and their family pursuit of understanding limitations of policies and fortitude related to insurance required within the public sphere.

Table 2
Core Democratic Dispositions

Open-Mindedness	Wholeheartedness	Responsibility
Tolerance	Self-discipline	Justice
Skepticism	Individual Responsibility	Compassion
Embracing Ambiguity	Patience	Generosity
Dissent	Persistence	Work for common good
Rationality	Compromise	Honesty
Embracing Diversity	Love of perfection	Respect rights of others
Curiosity	Loyalty	Respect property of others
Sympathy	Pursuit	Benevolence
Experimentation	Frankness	Dignity of others
	Fortitude	Opportunity
		Democratic principles
		Rule of law
		Fundamental human rights

Finally, as a result of this interdisciplinary inquiry, students are positioned to consider fundamental democratic principles concerning their own responsibilities to themselves and others, the rights of others (nationally and globally), as well as the relationship of insurance to dignity, law, and property. In addition to the simulation exercises, teachers can incorporate other activities that encourage students to embark on an inquiry into the normative and often controversial terrain of insurance in contemporary life. Specifically, students can be guided and shown how to apply what they have learned through simulation to questions related to Hurricane Katrina and national health insurance. For example:

1. Hurricane Katrina was the largest single loss to the U.S. insurance industry ($41 billion), yet the industry also experienced record profits of $44 billion in 2005, $63 billion in 2006, and $61 billion in 2007 (AAJ, 2008; Powell, 2007). This general trajectory of profit prompted the American Association for Justice CEO Jon Haber to indicate:

   > Insurance companies are making record profits while raising premiums, stiffing policyholders, and refusing insurance to those who need it most. Never has the industry taken in more and handed back less. Insurance CEOs have forgotten they have a duty to their policyholders, as well as shareholders (AAJ, 2008, para. 3).

   To what extent should the government regulate the insurance industry? Given the larger purpose of insurance, should we force insurance companies to be not-for-profit?

2. A recent court case involving an insurance claim from Hurricane Katrina reported there was confusion about water, wind, storm surges, and hurricanes. In this case, the company was attempting to disentangle whether the damage brought forth was primarily due to flood versus wind. In short, was the house that it destroyed very important? State Farm and other insurers covered damage from hurricane wind, but not water ($1 million State Farm, 2008).

   Is it legitimate to make this distinction? What criteria should be applied to determine the coverage decision?

3. Although the quality of American medical care is excellent, high health care costs dramatically exceed those of other developed nations. The average costs of health care for an individual is a significant problem, particularly to lower-and middle-income Americans (White House, 2012). To deal with this issue, the Obama administration passed a historic Patient Protection and Affordable Care Act (2010) into law, which created a health care system with more governmental direction that also extended health care coverage to millions of uninsured Americans.

   Should the U.S. government offer universal health care for all Americans? Whose money will the government use to pay for this? How can American medical care system support over 45 million uninsured Americans and avoid giving more financial burden to those who take their responsibilities of paying taxes and being healthy?

Final Thoughts

Both mathematics and social studies pedagogy courses have the mechanism to encourage preservice and inservice teachers to support constructivist techniques, where students generate their own knowledge rather than acquire this knowledge through traditional lecture methods. Insurance is a topic that easily fits within this approach as it calls upon a variety of teaching strategies that can meet the each student's unique needs in the classroom. The topic of insurance also provides an opportunity to teach about something that students will find relevant and meaningful that meets the content standards of both social studies and mathematics.

Integrating concepts that align themselves to other disciplines within the curriculum (in this case, social studies and mathematics) can enhance students' ability to think critically, synthesize their learning, and apply it to a range of situations within their lives. To this end, the careful planning and implementation of lessons that relate to multiple content areas with real life examples can afford students the opportunity to actualize their learning in meaningful ways. In this situation, teaching concepts of insurance that draws pedagogical engagement between mathematics and social studies to help students develop active citizenship encouraging them to not only evaluate an issue but also to apply it to normative and logical judgments about an issue in a practical and realistic way.

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Educational Tweets

Brenda Townsend Walker

Within recent years, there has been an increase in the number of children diagnosed with autism. While the reasons for the increase are not yet fully understood, the Centers for Disease Control (CDD) speculates that some of the increase may be due to "the way children are identified, diagnosed, and served in their local communities …" and "… by greater awareness by doctors, teachers, and parents." Dr. Peg Hughes tweets about a federally funded project implemented at San José State University, which prepared teachers of culturally and linguistically diverse backgrounds with graduate credentials to effectively work with children diagnosed with autism.

Special Education Teachers Evaluate F.A.C.E.S.—A Federally Funded Teacher Preparation Program in Early Childhood Special Education

Peg Hughes
San José State University
San José, California

The *New Families, Agencies, Communities, and Educational Strategies (FACES) in Early Childhood Special Education* was a four-year (2006~2010) federally funded project (H325K060108) designed to: (1) train 40 highly qualified culturally and linguistically diverse early childhood special education teachers in a graduate credential program with concentrations in the three areas (family-based practice, autism, and inclusion) using evidence-based practices, (2) prepare candidates to work collaboratively with family and community agencies, (3) identify and train seven university supervisors in the 10 counties of the Central California region, and (4) monitor, evaluate, and institutionalize program features, strategies, and outcomes to assure effectiveness and future support.

Of the seven project activities, four were focused on family-based practice (i.e., a neonatal intensive care unit visit including parent perspectives, the family resource agency orientation, an I-Tech activity with families, and family play group). The fifth activity was a two-day workshop about inclusive practices; the sixth activity was a 25 hour field-based practicum with families and their children with autism in play and social activities; and the last activity was attending an International Division of Early Childhood (DEC) conference.

The participants of this project were comprised of 5 males (13%) and 35 (87%) females from diverse backgrounds, including Euro-American (60%; n=24), Asian-American (20%; n = 8), and Latino (20%; n = 8). Upon completion of the credential program, each scholar was asked to rate the overall program effectiveness based on five different dimensions of quality—knowledge of the early childhood special education (ECSE) faculty, excellence in faculty teaching, achieving desired career goals, endorsement of the program to others, and preparation to enter the field.

The five dimensions were evaluated using a five interval rating scale with intervals of agreement ranging from 5 (strongly agree) to 1 (strongly disagree). Knowledge of the ECSE faculty received the highest rating (4.79). The second highest rating was excellence in teaching (4.71). Both achieving desired career goals and endorsement of the program received a 4.71 rating. The lowest rating was preparation to enter the field, which received a 4.64 rating.

When candidates were asked what attracted them to the New FACES program, most graduates (n=14) indicated financial support as most important, followed by the location of the university (n=9), program quality (n=9), faculty quality (n=7), program length (n=5), and class time (n=5). These ratings were supported by positive open-ended responses such as, "Great depth and breadth of classes," "helpful professors," "great DEC conference," "better prepared for the 'Real World'," and "use of evidence-based practice."

In terms of project activities, the most highly valued activities (mean scores 4.67 to 5.00) were the family resource agency orientation, field-based practice with families and children with autism, and the perspectives of parents who accompanied a visit to a Level 3 neonatal intensive care unit (NICU). One scholar commented, "to visit an NICU helped me develop genuine compassion for the children and families." Attendance at the DEC conference also emerged as a valued activity (mean score 4.54).

Although this federally supported graduate credential program has recently ended, the institutionalization of the activities from this program continues. To date, the following activities have been infused into the current ECSE credential program: inclusion practices, the fieldwork component with families and children with autism, and the family resource agency orientation. Currently, there are approximately 80 candidates is the ECSE program and we are continuing our efforts to recruit a more diverse population for this graduate credential program.

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Online Resources

Peggy Snowden ◆ Chauncey Carr-McElwee

The IRIS Center - is a national center that provides free online interactive training enhancements and resources for college and university faculty as well as professional development providers. The materials accessible on this site cover a wide variety of evidence-based topics, among which are RTI, collaboration, behavior and classroom management, differentiated instruction, content instruction, diversity, transition, disability, assistive technology, accommodations, assessment, math, and reading, literacy, and language arts.

MERLOT (Multimedia Educational Resource for Learning and Online Teaching) - is a free and open access online community of resources for higher education faculty, staff, and students for sharing their learning and teaching materials. The website offers a wealth of peer reviewed digital learning materials that can be incorporated into faculty designed courses across disciplines.

PBS Teachers - offers free high-quality Pre K-12 educational resources suitable for a wide range of subjects. This website provides lesson plans, teaching activities, interactive games, on-demand video assets, and interactive games and simulations. All of the resources on the site are correlated to state and national educational standards and are tied to PBS' award winning programming. PBS Teachers also provides professional development for educators through PBS TeacherLine, which offers more than 130 high quality professional development courses.

Project FORUM – was funded by the U. S. Department of Education. Although this site was finalized November 2011, it has an accessible database with more than 100 documents pertaining to various critical policy issues in the field of special education.

QuizStar – a free online web-based quiz making tool that enables teachers to create online quizzes for their students in different formats, including multiple choice, true/false, and short answer. With quiz star, teachers can create quizzes for students to take online and efficiently organize the results, make quizzes in multiple languages, attach multimedia files to questions, grade quizzes automatically, and view quiz results online. Students can login to QuizStar to search for their classes, take quizzes, and review their quiz results. QuizStar can be accessed from any internet-connected computer.

Sheppard Software – a website that provides educational software and online games with sound and visual effects at various difficulty levels to enhance learning and exercise the brain. Activities are recommended for students at various grade levels (Preschool, Kindergarten, elementary school, middle school, and high school), college level, and adults. This website also has sections with links to activities, quizzes, and free articles.

The Event Zone

Martha Jallim Hall ◆ *Michael J. Maiorano*

Learning Forward 2012 Summer Conference
Lead. Inspire. Empower
July 22-25, 2012
Denver, Colorado

Educational Theatre Association Annual Conference
Developing the Innovative Mind
September 20-23, 2012
Coronado, California
(San Diego, California)

ISTEL
International Society for Exploring Teaching and Learning
October 11 - 13, 2012
San Antonio, Texas

NAEHCY Annual Conference
National Association for the Education of Homeless Children and Youth
Red Hot Solutions: Educating all Our Children
October 27-30, 2012
Albuquerque, New Mexico

National Forum on Character Education
Developing Leaders of Integrity
November 1-3, 2012
Washington, DC

SSMA Annual Convention
School Science and Mathematics Association
E-merging Math & Science
November 8-10, 2012
Birmingham, Alabama

2012 ASHE Annual Conference
Association for the Study of Higher Education
Freedom to Learn
November 14-17, 2012
Las Vegas, Nevada

2012 ASHA Conference
American Speech-Language Hearing Association
Evidence of Excellence: Opportunities and Outcomes!
November 15-17, 2012
Atlanta, Georgia

NAGC Annual Convention and Exhibition
National Association for Gifted Children
Reaching Beyond the Summit: Education with Altitude
November 15-18, 2012
Denver, Colorado

NCSS Annual Conference
National Council for Social Studies
Opening Windows of the World
November 16-18, 2012
Seattle, Washington

Complimentary Webinars
by
Innovative Educators: Supporting Academic & Professional Growth in Higher Ed

July 19, 2012
Using Rubrics in Student Affairs: A Direct Assessment of Learning

October 12, 2012
Conference: Leveraging Technology to Support Students, Faculty, and Staff

Available on Demand . . . And More!
Support Services for Online Students: Strategies for Success

YouTube and Wikipedia: Education Game-Changers

Establishing Course Guidelines and Expectations that Improve Student Success and Satisfaction