www.ijres.net

International Journal of Research in Education and Science (IJRES)

Alleviating Mathematics Anxiety of Elementary School Students: A Situated Perspective

Yogesh Sharma
Ramgarhia College of Education, India,
mathematicalcreativity@gmail.com

To cite this article:

Sharma, Y. (2016). Alleviating mathematics anxiety of elementary school students: A situated perspective. *International Journal of Research in Education and Science (IJRES), 2*(2), 509-517.

International Journal of Research in Education and Science
Volume 2, Issue 2, Summer 2016 ISSN: 2148-9955

Alleviating Mathematics Anxiety of Elementary School Students: A Situated Perspective

Yogesh Sharma*
Ramgarhia College of Education, India

Abstract

The present study investigates the effects of the situated learning and effortful control on mathematics anxiety of school students. Participants were 99 seventh graders who studied in two schools. Students in one of these were given instruction through the situated learning model, and the students of other school were treated as a control group. Existing instruments, namely, Mathematics Anxiety Scale by Sharma and Sansanwal (2011) and Effortful Control Scale by Lonigan and Phillips (2001) were used to measure mathematics anxiety and effortful control. Data were analyzed by using 2 × 2 factorial design analysis of covariance. Results indicated that after the experiment students who were exposed to the situated learning model had significantly less mathematics anxiety than their counterparts who were in the control group with effect size .35. The implications of the study are discussed.

Key words: Mathematics anxiety; Situated learning; Effortful control

Introduction

As the pervasive technologies of our times are, and will continue to be, substantially based on, and enablers of, mathematics (AAMT, 2009), the mathematics has become a critical filter for employment and full participation in our society (NCTM, 1989). Likewise, the Stockholm Declaration advocates, the 21st century require deeper-than-ever understanding of science, technology, engineering and mathematics, along with the humanities, for both employability and citizenry, whereas mathematics is an essential foundation of such a deep understanding (CCR, 2013). More recently, NCTM (2014) emphasizing the importance of mathematics has set forth Principles to Actions - the conditions, structures, and policies that must exist for all students to learn mathematics. However, teaching challenging mathematics to school students gets impeded by mathematics anxiety. The detrimental effects of mathematics anxiety on learning and understanding of mathematics has been well documented (Liebert & Morris, 1967; Richardson & Suinn, 1972; Morris, Davis, & Hutchings, 1981; Sarason, 1986; Eccles & Jacobs, 1986; Wigfield & Meece, 1988; Cooper & Robinson, 1989; Hembree, 1990; Engelhard, 1990; Green, 1990; Tocci & Engelhard, 1991; Ma, 1999; Sherman & Wither, 2003; Ashcraft, Krause, & Hopko, 2007; Krinzinger, Kaufmann, & Willmes, 2009; Rubinsten & Tannock, 2010; Núñez-Peñaa, Suárez-Pellicionia, Bono, 2013; Kiray, Gok & Bozkir, 2015). The higher one's level of mathematics anxiety, the lower one's score is on mathematics achievement tests, the fewer mathematics courses one takes, and the lower one's grades are in the mathematics courses that are taken (Ashcraft and Moore, 2009).

Besides, Chin (2009) found high levels of mathematics anxiety in approximately 4% of students. So, mathematics anxiety is an important construct to consider when examining sources of individual differences in young children's mathematical performance (Vukovic, Kieffer, Bailey, Harari, 2013). Mathematics anxiety can be defined as a learned phenomenon on account of which an individual has negative cognitive and affective reactions (worry-fear/tension/physiological reactions) towards mathematics (Morris & Liebert, 1970; Schwarzer, Van Der Ploeg, & Spielberg, 1982; Wigfield & Meece, 1988; Ho, Senturk, Lam, Zimmer, Hong, Okamoto et al., 2000; Sheffield & Hunt, 2007).

The debilitating effects of mathematics anxiety on mathematics performance can be seen in the early childhood. For instance, Ramirez, Gunderson, Levine, & Beilock (2013) found a negative relation between mathematics anxiety and mathematics achievement for children who were higher but not lower in working memory for a sample of second-grade children; the higher levels of mathematics anxiety contributed to lower gains in children's mathematical applications, but only for children with higher levels of visual–spatial working memory in case of second and third grade students (Vukovic, Kieffer, Bailey, & Harari, 2013). And, if necessary actions

* Corresponding Author: *Yogesh Sharma, mathematicalcreativity@gmail.com*

are not taken to alleviate mathematics anxiety of students at the elementary and secondary grades, the negative impacts of mathematics anxiety on mathematics performance continue in the adulthood (Capraro, Capraro & Henson, 2001; Miller & Bichsel 2004; Baloğlu & Koçak, 2006; and Ramirez, Gunderson, Levine, & Beilock, 2013).

This calls for the introduction of certain programs for alleviation of mathematics anxiety at school stage. This may in turn result in better mathematics performance. A number of studies have been done in which efforts have been made to alleviate mathematics anxiety of students. Hellum-Alexander (2010) reviewed and synthesized current research and found that mathematics anxiety can be treated with direct interventions such as relaxation therapy, or indirectly, with the teaching style and cooperative learning. Jansen, Louwerse, Straatemeier, Van der Ven, Klinkenberg, & Van der Maas (2013) investigated whether children would experience less mathematics anxiety and feel more competent when they, independent of ability level, experienced high success rates in mathematics. Mathematics anxiety scores improved equally in all conditions. Though, certain classroom interventions in the past like concentrated effort to improve students' achievement, heuristic versus algorithmic instruction, special class work in microcomputers, provision of special equipments (for example, calculators), and special techniques for presenting material (tutorial, small-group, and self-paced) as well as whole-class psychological treatment were not effective in reducing mathematics anxiety in terms of effect size (Hembree, 1990).

The author assumes that in order to engage every child in mathematics classroom, it is needed to develop more interventions for alleviation of mathematics anxiety. Watson & Winbourne (2008), as, mentioned that school mathematics continues to be a social gatekeeper, making it imperative to continue to analyse how and why some succeed and others do not, and also to critique the role itself. In this context, one approach that can be tried for alleviating mathematics anxiety and consequently improving mathematics performance is situated learning - the instructional application of situated cognition theory (Huang, Lubin, Ge, 2011). Likewise, Lave and Wenger (1991) posited that learning should not be viewed as simply the transmission of abstract and decontextualised knowledge from one individual to another, but a social process whereby knowledge is co-constructed and in situated learning, knowledge is seen not as individual cognitive structures but as a creation of the community over time (Woolfolk, 2004).

Consequently, different successful classroom interventions are premised upon situated learning perspective. These are problem-based learning (Barrows & Tamblyn, 1980), cognitive apprenticeship (Collins, Brown, & Newman, 1989; & Collins, 2006), anchored instruction (Cognition and Technology Group at Vanderbilt, 1992, 1993), literature books for authentic contexts (Kumar & VoIdrich, 1994), situated learning in cyberspace (Youn, 2005), task-oriented collaborative learning (Develotte, Mangenot & Zourou, 2005), abstract algebra classroom (Ticknor, 2012), learning environments approaching professional situation (Lubin, 2005; Huang, Lubin, Ge, 2011; Lubin, Ge, 2011), three-level model of learning (Korthagen, 2010), professional dialogic interactions and modeling of pedagogic strategies (Saigal, 2012), situated learning program (Hossainy, Zare, Hormozi, Shaghaghi, & Kaveh, 2012), situated learning with online portfolios, classroom websites and Facebook (Shaltry, Henriksen, Wu & Dickson, 2013) and communities of practice (Barab & Duffy, 2000, 2012; Wenger, 1998).

However, in contrast to these studies where implications for situated learning were drawn for different aspects of education, the purpose of the present study was to examine the effects of the situated learning on mathematics anxiety of students in the upper elementary school grades. Moreover, the study also focused on investigating the relationship between moderate variable i.e., effortful control - a capacity for self-regulation that emerges in children's development, including the ability to inhibit behavior effortfully (inhibitory control), to activate behavior when needed (activation control), and to voluntarily focus or shift attention (attentional control) (Verstraeten, Vasey, Claes & Bijttebier, 2010) and mathematics anxiety. For mathematics knowledge and letter knowledge, self-regulation measured both in preschool and in kindergarten accounted for significant variation (Blair & Razza, 2007). Recent and growing empirical evidence points to a linkage between effortful control and academic achievement in young school-aged children, including those from low-income and ethnic minority backgrounds (Liew, 2011).

The specific research questions, thus, addressed were:

1. Does the situated learning model effective in alleviating mathematics anxiety?
2. How does effortful control relate to mathematics anxiety for grade VII students?
3. Is there an interaction between treatment and effortful control in regard to mathematics anxiety?

Method

Participants

The participants were 99 seventh-grade students (60 boys and 39 girls) from two senior English medium high schools. The schools were purposively selected to achieve comparability across different types of schools. However, when measured on effortful control, some differences were observed in effortful control of students from two different schools. The classroom size in each school was comparable (49 and 50 each). The students' mean age was 12.5 years old, and in each school students belonged to different socioeconomic strata.

Instrumentation

Mathematics Anxiety Scale. The mathematics anxiety scale developed by Sharma and Sansanwal (2011) was used as a measure of mathematics anxiety. The mathematics anxiety scale comprises 44 items pertaining to cognitive and affective dimensions. There was no time limit but generally students took 25 minutes. There were 22 positive items and 22 negative items. The positive items were scored as 1, 2 and 3 for yes, undecided and no, while the reverse items were scored as 3, 2 and 1 for yes, undecided and no. The test-retest reliability and split-half reliability coefficients were reported as .80 and .82 respectively. They also reported a criterion validity (The mathematics achievement test developed by L.N. Dubey was used as a measure of mathematics achievement) as –.74.

Effortful Control Scale (ECS). For assessing effortful control of students, ECS (Lonigan & Phillips, 2001) was used. The ECS is a 24-items self-report questionnaire with a 5-point rating scale, tapping persistent/Low Distractibility and Impulsivity (12 items each). The sum of score is the total effortful control score. Verstraeten, Vasey, Claes and Bijttebier (2010) supported the construct validity of ECS and found it more appropriate for use in broader age ranges.

Procedure

The study was designed on the lines of the non-equivalent control group design (Campbell and Stanley, 1963). The design controls for most of the factors jeopardizing internal validity like history, maturation, testing, instrumentation, selection and mortality. The possible effect of regression was controlled as sample was not selected on the basis extreme score and matching was not done for establishing the pre-experimental equivalence of groups.

Two English medium schools were selected for the study. One school was designated as experimental group and the other as control group. The experimental group was randomly assigned to the treatment. At the conclusion of the study there were 49 students in the experimental situated learning group (37 male and 12 female), and 50 students in control group (23 male and 27 female).

Pretesting: Before the start of the experiment, mathematics anxiety scale developed by Sharma and Sansanwal (2011) was administered on both experimental group and control group students. The pretest scores on mathematics anxiety scale constituted pre-mathematics anxiety of grade VII students.

Treatment: After pretesting, the situated intervention was implemented on the students of experimental group only. The situated intervention was executed by a volunteer. Situated learning theory tends to exist in diverse forms such as cognitive apprenticeship, community of practice, or legitimate peripheral participation (Hendricks, 2001). In the present study, the intervention was premised on the situated learning model given by McLellan (1991, 1996). The key components of the situated learning model are stories, reflection, cognitive apprenticeship, collaboration, coaching, multiple practices, articulation of learning skills and technology. These components are thoroughly discussed by the researchers in the past (Brown, Collins, & Duguid, 1989; McLellan, 1996; Lunce, 2006; Collins, 2006; and Herrington & Oliver, n.d).

The lessons were developed on these eight key components of situated leaning model - four each on reflection, and technology; three each on cognitive apprenticeship, articulation of learning skills and collaboration; and two each on stories and multiple practice. However, for supporting technology component, video tutorials from you tube were downloaded; in relation to articulation of learning skills component, as McLellan (1996) suggested, problem solving was taken into consideration [Problem Solving Model by Polya (1957), to be specific] was used; collaboration aspect was dealt with Jigsaw II (Slavin, 1994); vis-à-vis cognitive apprenticeship, lessons were developed based on the synthesis of Van Hiele's theory and cognitive apprenticeship recommended by Dimakos & Nikoloudakis (2008); and with respect to multiple practice, linear programmed instruction material was prepared. Furthermore, in order to assist students' reflection, specific prompts were provided. The lessons were developed in English language, as per the syllabus prescribed by central board of school education, New Delhi, India for grade VII students.

On the other hand, the control group students were taught by traditional method of teaching by their respective teachers. However, the control group students were taught the same topics that were taught to the students of experimental group. In traditional method of teaching, a concept was presented and related formula was given to students. After this, teachers solved related problems on the black board. At the end, teachers gave home assignments to the students.

However, in traditional method of teaching, the aspects of situated learning model were not there. And, there was no chance of diffusion as participants of experimental and control groups belonged to two different schools. The efforts were made to make the teaching environment similar in both the experimental and control group expect the fact that the experimental group was taught with situated intervention based on situated learning model given by McLellan (1991, 1996), while control group students were taught with traditional method. Moreover, during the period of treatment, effortful control of both experimental and control group students were assessed with the help of effortful control scale by Lonigan & Phillips (2011).

Posttesting: The treatment lasted for 25 days at the rate of 35 minutes per day in both groups in both schools. At the end of the treatment, the mathematics anxiety scale developed by Sharma and Sansanwal (2011), which was administered on the first day on the students of both experimental group and control group as pretest, was administered again. The posttest scores on mathematics anxiety scale constituted mathematics anxiety of grade VII students.

Statistical Analyses

There were two levels of treatment, namely, teaching with situated learning model and traditional method. The students were categorized into two levels of effortful control, namely, high and low. The categorization was made on the median of effortful control scores. Thus, there were two levels of treatment and two levels of effortful control. Thus, 2 × 2 analysis of co-variance (ANCOVA) was conducted to test for main effects of treatment (teaching with situated learning model vs. traditional method) and group (high effort control vs. low effortful control participants) as well as interaction on mathematics anxiety scores of grade VII students. The covariate being taken was pre-mathematics anxiety scores. The analyses were made with SPSS 21.0, and the alpha level was set to 0.05.

Results

Descriptive data on the mathematics anxiety scores for the various groups are shown in Table 1. Table 2 shows the results of the ANCOVA testing the effects of the treatment, and effortful control, on estimated mathematics anxiety, controlling for pre-mathematics anxiety.

Table 1. Adjusted (and unadjusted) means, standard deviation of scores on mathematics anxiety scale and number of participants for various groups.

Treatment	Effortful Control	Mean	Standard Deviation	N
Situated Learning Model	High	69.27(69.19)	11.49	32
	Low	68.69(68.06)	10.08	17
	Total	68.98(68.62)	10.93	49
Traditional Method	High	77.62(78.20)	13.25	15
	Low	78.80(78.97)	15.35	35
	Total	78.21(78.58)	14.62	50

Table 2. Main effects and (tested) interactive effects of treatment, and effortful control, on estimated mathematics anxiety

Sum of variance	Sum of squares	df	Mean sum of squares	F-value	p
Treatment	1778.364	1	1778.364	49.853	<0.01
Effortful control	1.868	1	1.868	.052	>0.05
Treatment x Effortful Control	16.178	1	16.178	.454	>0.05
Error	3353.166	94	35.672		

Main Effects of Treatment

From Table 2, it can be seen that F (1, 94) = 49.853, p<0.01 is significant. Eta for treatment was .35, which, according to Cohen (1988) is medium to large effect. It indicates that after the treatment period, mathematics anxiety of students taught with situated learning model decreased as compared to the students of traditional method group (see Table 1).

Main Effects of Effortful Control

From Table 2, it can be seen that F (1, 94) = .052, p>0.05 is not significant. It indicates that mathematics anxiety was not correlated with effortful control of grade VII students.

Interaction Effect

From Table 2, it can be seen that F (1, 94) = .454, p>.05 is not significant. It indicates that mathematics anxiety is found to be independent of the interaction between treatment and effortful control when pre-mathematics anxiety is taken as a covariate.

Discussion

At the start of this study, it was observed that mathematics is of paramount importance for global development whereas mathematics anxiety impedes the learning of mathematics and puts restraints on students' future mathematics participation. So, alleviation of mathematics anxiety is of key significance for classroom research. The present study showed that context based learning had medium to large positive effect on alleviation of mathematics anxiety.

It points out that along with other strategies as summarized by Hellum-Alexander (2010) and Blazer (2011), situated learning model of McLellan (1991, 1996) can be also be used effectively for the alleviation of mathematics anxiety in elementary school students. Thus, the first research question was answered in affirmative that situated learning model is effective in alleviating mathematics anxiety. The study by Alsup (2004) had also established the effectiveness of constructivist instruction in reducing the mathematics anxiety. However, the participants in that study were pre-service elementary teachers.

Apropos research questions 2 and 3, data from the present study suggested that mathematics anxiety dose not relates with effortful control and no interaction was found between treatment and effortful control in regard to mathematics anxiety. Thus, effortful control was not critical variable in the context of mathematics anxiety. And thus, effortful control of students may not be considered while teaching with situated learning model.

The treatment with situated learning model was performed by a volunteer instead of the class teacher, thus raising question of experimenter effect – a concern for internal validity. While situated learning model was found to be effective in the alleviation of mathematics anxiety, to substantiate this finding no qualitative data was sought in the study. Another limitation of the study was the relatively short treatment period. This solicits replication of the study in the qualitative framework with longer treatment period.

Implications

Formal school environments rarely attempt to provide opportunities outside the fixed curriculum. Much emphasis is given to the completion of syllabi with traditional methods that are not context based and are divorced from real life settings. Thus, ignores the social context of learning. Brown, Collins & Duguid (1989) argued that the activity, in which knowledge is developed and deployed, is not separable from or ancillary to learning and cognition. They suggested that by ignoring the situated nature of cognition, education defeats its own goal of providing useable, robust knowledge. The present study extends the literature by emphasizing that the situated learning not only provides durable knowledge but can also be useful in alleviating mathematics anxiety of school students. Mathematics embedded in social activity can be a source of pleasure for the students and seeks a welcome from teacher fraternity. The situated cognition may help in changing the predisposition of larger community that mathematics is difficult and horrible. McLellan (1996) suggested that the situated learning model provides a valuable tool for enhancing the design and implementation of learning experiences, however, a great deal of work is needed to fine-tune theory and assess how to transform theory into practice. Indeed, it can be concluded that the situated perspective has much to offer in school mathematics program and requires implementation as well as further exploration. Although the study was done on a sample of elementary school students, the work can be broadened to include students from different age groups. The activities undertaken in situated learning model can be designed for higher classes, also.

References

AAMT (2009). School mathematics for the 21st century: Some key influences. Retrieved from www.aamt.edu.au/content/download/8004/.../file/infl_paper_ma21c.pdf

Ashcraft, M. H., Krause, J. A., & Hopko, D. R. (2007). Is math anxiety a mathematical learning disability? In D. B. Berch & M. M. M. Mazzocco (Eds.), Why is math so hard for some children? The nature and origins of mathematical learning difficulties and disabilities (pp. 329-348). Baltimore: Brookes.

Baloğlu, M., & Koçak, R. (2006). A multivariate investigation of the differences in mathematics anxiety. Personality and Individual Differences, 40, 1325–1335.

Barab, S. A. & Duffy, T. M. (2000). From practice fields to communities of practice. In D. H. Jonassen & S. M. Land (Eds.), Theoretical foundations of learning environments (pp. 25-55). Mahwah, NJ: Lawrence Erlbaum Associates.

Barab, S. A., & Duffy, T. (2012). From practice fields to communities of practice. In D. Jonassen, & S. Land (Eds.), Theoretical Foundations of Learning Environments (pp. 29-65). NY: Routledge.

Barrows, H. S., & Tamblyn, R. M. (1980). Problem-based learning: An approach to medical education. New York: Springer.

Blair, C., & Razza, R. P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. Child Development, 78, 647–663. doi:10.1111/j.1467-8624.2007. 01019.x

Blessman, J. & Myszczak, B. (2001). Vocabulary and Its Effect on Student Comprehension. Illinois: Author. Abstract retrieved March 30, 2004, from ERIC database.

Campbell, D.T., & Stanley, J.C. (1963). Experimental and Quasi-Experimental designs for Research in teaching. In N.L. Gage (Ed.), Handbook of research on teaching – A project of the American Educational Research Association (pp. 171–246). Chicago: Rand McNally and Company.

Capraro, M. M., Capraro, R. M., & Henson, R. K. (2001). Measurement error of scores on the mathematics anxiety rating scale across studies. Educational and Psychological Measurement, 61, 373–386. http://dx.doi.org/10.1177/00131640121971266.

CCR (2013). The Stockholm declaration: Mathematics for the 21st century. Retrieved from http://curriculumredesign.org/wp-content/uploads/Stockholm-Declaration-CCR-FINAL.pdf

Chin, S. (2009). Mathematics anxiety in secondary students in England. Dyslexia, 15, 61-68.

Cognition and Technology Group at Vanderbilt. (1992). An anchored instruction approach to cognitive skills acquisition and intelligent tutoring. In J. W. Region & V. J. Shute (Eds.), Cognitive approaches to automated instruction (pp. 135-170). Hillsdale, NJ: Lawrence Erlbaum Associates.

Cognition and Technology Group at Vanderbilt. (1993) The Jasper series: Theoretical foundations and data on problem solving and transfer. In L.A. Penner, G. M. Batsche, H. M. Kno, & D. L. Nelson (Eds.), The challenge in mathematics and science education: Psychology's response, Washington (pp. 113-152). DC: American Psychological Association.

Collins, A. (2006). Cognitive apprenticeship. In R. K. Sawyer (Ed.), The Cambridge handbook of learning science (pp. 47- 60). New York Cambridge University Press.

Collins, A., Brown, J. S., & Newman, S. E. (1989). Cognitive apprenticeship: teaching the crafts of reading, writing, and mathematics. In L. B. Resnick (Ed.), Knowing, learning, and instruction: Essays in honor of Robert Glaser (pp. 453-494). Hillsdale, NJ: Lawrence Erlbaum Associates.

Cooper, S.E., & Robinson, D.A.G. (1989). The Influence of gender and anxiety on mathematics performance. Journal of College Student Development, 30(5), 459-461.

Develotte, C., Mangenot, F., & Zourou, K. (2005). Situated creation of multimedia activities for distance learners: Motivational and cultural issues. ReCALL, 17(2), 229-244.

Dimakos, G., & Nikoloudakis, E. (2008). Teaching Euclidean geometry using a synthesis by two well known theories: Van Hiele's theory and cognitive apprenticeship. Far East Journal of Mathematical Education, 2(2), 187-217.

Eccles, J.S., & Jacobs, J.E. (1986). Social forces shape math attitudes and performance. Signs: Journal of Women in Culture and Society, 11(2), 367-380.

Engelhard, G., Jr. (1990). Math anxiety, mother's education, and the mathematics performance of adolescent boys and girls: Evidence from United States and Thailand. Journal of Psychology, 124, 289-298.

Green, L. (1990). Test anxiety, mathematics anxiety, and teacher comments: Relationships to achievement in remedial mathematics classes. Journal of Negro Education, 59(3), 320-335.

Hellum-Alexander, A. (2010). Effective teaching strategies for alleviating math anxiety and increasing self-efficacy in secondary students. Unpublished Project of Master of Teaching at The Evergreen State College. Retrieved from http://www.jarwan-center.com/download/english_books/university__dissertations/Effective%20Teaching%20Stratigies%20for%20Alleviating%20Math%20Anxiety.pdf

Hembree, R. (1990). The nature, effects, and relief of mathematics anxiety. Journal of Research in Mathematics Education, 21(1), 33-46.

Hendricks, C. C. (2001). Teaching causal reasoning through cognitive apprenticeship: What are results from situated learning? The Journal of Educational Research, 94(5), 302-310.

Herrington, J., & Oliver, R. (n.d.). Critical characteristics of situated learning: Implications for the instructional design of multimedia. Retrieved from http://www.ascilite.org.au/conferences/melbourne95/smtu/papers/herrington.pdf

Ho, H.-Z., Senturk, D., Lam, A.G., Zimmer, J.M., Hong, S., Okamoto, Y., et al. (2000). The Affective and Cognitive Dimensions of Math Anxiety: A Cross-National Study. Journal for Research in Mathematics Education, 31(3), 362-379.

Hossainy, F., Zare, H., Hormozi, M., Shaghaghi, F., & Kaveh, M. (2012). Designing and implementing a situated learning program and determining its impact on the students' motivation and learning. Turkish Online Journal of Distance Education, 13(2), 36-47.

Huang, K., Lubin I. A., & Ge, X. (2011). Situated learning in an educational technology course for pre-service teachers. Teaching and Teacher Education, 27, 1200-1212. doi:10.1016/j.tate.2011.06.006

Jansen, B. R. J., Louwerse, J., Straatemeier, M., Van der Ven, S. H. G., Klinkenberg, S., & Van der Maas, H. L. J. (2013). The influence of experiencing success in math on math anxiety, perceived math competence, and math performance. Learning and Individual Differences, 24, 190-197. http://dx.doi.org/10.1016/j.lindif.2012.12.014

Kiray, S.A., Gok, B., & Bozkir, A.S. (2015). Identifying the factors affecting science and mathematics achievement using data mining methods. Journal of Education in Science, Environment and Health (JESEH), 1(1), 28-48.

Korthagen, F. (2010). Situated learning theory and the pedagogy of teacher education: Towards an integrative view of teacher behavior and teacher learning. Teaching and Teacher Education, 26, 98–106.

Krinzinger, H., Kaufmann, L., & Willmes, L. (2009). Math anxiety and math ability in early primary school years. Journal of Psychoeducational Assessment, 27, 206–224. DOI:10.1177/0734282908330583

Kumar, D. & VoIdrich, J. F. (1994). Situated cognition in second grade science: Literature books for authentic contexts. Journal of Elementary Science Education, 6(2), 1-10.

Lave, J., & Wenger, E. (1991). Situated learning. Legitimate peripheral participation. Cambridge: Cambridge University Press.

Liebert, R.M., & Morris, L.W. (1967). Cognitive and emotional components of test anxiety: A distinction and some initial data. Psychological Reports, 20, 975-978.

Liew, J. (2011). Effortful control, executive functions, and education: Bringing self-regulatory and social-emotional competencies to the table. Child Development Perspective, 0(0), 1-7. Retrieved from

http://www.tdschools.org/wp-content/uploads/2013/12/2011-1.-Liew-2011-Child-Development-Perspectives.pdf
Lonigan, C. J., & Phillips, B. M. (2001). Temperamental influences on the development of anxiety disorders. In M. W. Vasey & M. R. Dadds (Eds.), The developmental psychopathology of anxiety (pp. 60–91). New York: Oxford University Press.
Lubin, I. A. (2005). A study comparing learning environments for teaching educational technology to pre-service teachers. Unpublished master's thesis. Norman, OK: University of Oklahoma.
Lubin, I. A., & Ge, X. Investigating the influences of a LEAPS model on pre-service teachers' problem solving, metacognition, and motivation in an educational technology course. Educational Technology Research and Development, 60(2), 239-270.
Lunce, L. M. (2006). Simulations: Bringing the benefits of situated learning to the traditional classroom. Journal of Applied Educational Technology, 3(1), 37-45. Retrieved from http://www.eduquery.com/jaet/JAET3-1_Lunce.pdf
Ma, X. (1999). A meta-analysis of the relationship between anxiety toward mathematics and achievement in mathematics. Journal for Research in Mathematics Education, 30, 520–540.
McLellan, H. (1991). Virtual environments and situated learning. Multimedia Review, 2(3), 30-37.
McLellan, H. (1996). Situated learning perspectives. New Jersey: Educational Technology Publications, Inc.
Miller, H., & Bichsel, J. (2004). Anxiety, working memory, gender, and math performance. Personality and Individual Differences, 37, 591–606. http://dx.doi.org/10.1016/j.paid.2003.09.029.
Morris, L.W., & Liebert, R.M. (1970). Relationship of cognitive and emotional components of test anxiety to physiological arousal and academic performance. Journal of Consulting and Clinical Psychology, 35, 332-337.
Morris, L.W., Davis, M.A., & Hutchings, C.H. (1981). Cognitive and emotional components of anxiety: Literature review and a revised worry-emotionality scale. Journal of Educational Psychology, 73, 541-555.
NCTM. (1989). Curriculum and evaluation standards for school mathematics. Reston, VA: Author.
NCTM. (2014). Principles to Actions: Ensuring Mathematics Success for All. Reston, VA: Author.
Núñez-Peñaa, M. I., Suárez-Pellicionia, M., & Bono, R. (2013). Effects of math anxiety on student success in higher education. International Journal of Educational Research, 58, 36-43. http://dx.doi.org/10.1016/j.ijer.2012.12.004
Ormrod, J. E. (2012). Human learning (6th ed.). Delhi: Pearson.
Polya, G. (1957). How to solve it. NY: Princeton University Press.
Ramirez, G., Gunderson, E. A., Levine, S. C., & Beilock, S. L. (2012). Spatial anxiety relates to spatial abilities as a function of working memory in children. The Quarterly Journal of Experimental Psychology. http://dx.doi.org/10.1080/17470218.2011.616214.
Richardson, F.C., & Suinn, R.M. (1972). The mathematics anxiety rating scale: Psychometric data. Journal of Counseling Psychology, 19, 551-554.
Rubinsten, O., & Tannock, R. (2010). Mathematics anxiety in children with developmental dyscalculia. Behavioral and Brain Functions, 6(46). www.behavioralandbrainfunctions.com/content/6/1/46
Saigal, A. (2012). Demonstrating a situated learning approach for in-service teacher education in rural India: The quality education programme in Rajasthan. Teaching and Teacher Education, 28, 1009-1017. http://dx.doi.org/10.1016/j.tate.2012.05.007
Sarason, I.G. (1986). Test anxiety, worry and cognitive interference. In R. Schwarzer (Ed.), self-related cognitions in anxiety and motivation. Hillsdale, NJ: Erlbaum.
Schwarzer, R., Van der Ploeg, H.M., & Spielberger, C.D. (1982). Test anxiety: An overview of theory and research. In H.M. Van der Ploeg, R. Schwarzer and C.D. Spielberger (Eds.), Advances in test anxiety research (Vol. 3, pp. 277-285). Hillsdale, NJ: Erlbaum.
Shaltry, C., Henriksen, D., Wu, M. L., & Dickson, W. P. (2013). Teaching pre-service teachers to integrate technology: Situated learning with online portfolios, classroom websites and facebook. TechTrends, 57(3), 20-25.
Sharma, Y., & Sansanwal, D.N. (2011). Construction of a standardized scale for measuring mathematics anxiety in school children. Experiments in Education, XXXIX (1), 31-32.
Sheffield, D., & Hunt T. (2007). How does anxiety influence math performance and What can we do about it? MSOR Connections, 6(4), 19-21. Retrieved from http://mathstore.gla.ac.uk/headocs/6419_anxietymaths.pdf
Sherman, B.F., & Wither, D.P. (2003). Mathematics anxiety and mathematics achievement. Mathematics Education Research Journal, 15(2), 138-150.
Slavin, R. E. (1994). Using student team learning (4th ed.). Baltimore: Johls Hopluns University, Center for Research on Elementary and Middle Schools.

Ticknor, C. S. (2012). Situated learning in an abstract algebra classroom. Educational Studies in Mathematics, 81, 307-323. DOI: 10.1007/s10649-012-9405-y

Tocci, C.M., & Engelhard, G., Jr. (1991). Achievement, parental support, and gender differences in attitude toward mathematics. Journal of Educational Research, 84(5), 280-286.

Verstraeten, K., Vasey, M. W., Claes, L., & Bijttebier, P. (2010). The assessment of effortful control in childhood: Questionnaires and the test of everyday attention for children compared. Personality and Individual Differences, 48, 59–65. doi:10.1016/j.paid.2009.08.016

Vukovic, R. K., Kieffer, M. J., Bailey, S. P., & Harari, R. R. (2013). Mathematics anxiety in young children: Concurrent and longitudinal associations with mathematical performance. Contemporary Educational Psychology, 38, 1–10. http://dx.doi.org/10.1016/j.cedpsych.2012.09.001

Watson, A., & Winbourne, P. (2008). New directions for situated cognition in mathematics education. Mathematics Education Library, 45, 1-359.

Wenger, E. (1998). Communities of practice: Learning, meaning, and identity. Cambridge, England: Cambridge University Press.

Wigfield, A., & Meece, J.L. (1988). Math anxiety in elementary and secondary school students. Journal of Educational Psychology, 80(2), 210-216.

Woolfolk, A. (2004). Educational psychology (9th ed.). Boston, MA: Allyn & Bacon.

Youn, S. K. (2005). Situated learning in cyberspace: A study of an American online school. Unpublished Doctoral Dissertation, Ohio State University. Retrieved from https://etd.ohiolink.edu/ap/10?0::NO:10:P10_ETD_SUBID:64100

Zakaria, E., & Nordin,N.M. (2008), The Effects of mathematics anxiety on matriculation students as related to motivation and achievement. Eurasia Journal of Mathematics, Science & Technology Education, 4(1), 27-30.