The Multiplication Factor of the Micro Spiral Methodology and achieving lasting learning outcomes.

Edith G. Davis, Ed.D.

Associate Professor, Florida A & M University, Gore Education Complex, Tallahassee, FL

DOI: https://doi.org/10.56293/IJASR.2024.5707

IJASR 2024
VOLUME 7
ISSUE 1 JANUARY – FEBRUARY **ISSN: 2581-7876**

Abstract: The COVID-19 Pandemic has adversely affected every sector of our World. The battered sector of Education has once again taken a major hit in their plight to educate the World's citizens. The transfer of concepts, knowledge, and skills has been delayed, interrupted, and in some cases stopped. Providing the Micro-Spiral Method train-the-trainer model, which assists in reducing absenteeism and loss of instructional time as well as encoding concepts, knowledge, and skills into the left and right side of the brain can help overcome some adverse effects on the educational system. The Micro-Spiral Methodology or MSM has been scientifically proven to help children learn and retain information at an accelerated rate. To equip today's students for the future, we need to understand the fundamental building blocks of complex skills and apply that understanding to teaching practices and assessments. The Micro-Spiral Method works: It delivers small chunks of information to students multiple times, going more in-depth each time. This "spiral," as it is called, reinforces old information and builds on new. The teachers who teach using the Micro Spiral Method give your child a better chance at success. The purpose of this application is to provide pre-service and in-service educators with strategies for training their undergraduate and graduate students' usage of the multiplication factors of Micro-Spiral Methodologies (MSM) to improve K-12 understanding of any Subject, particularly focusing on Science, Technology, Engineering, and Math (STEM).

Keywords: Science Education; Micro Spiral Methodology, Multiplication Factor, K-12 students, Pre-service and In-service Educators, Teach the Teachers MSM Workshops

1. Introduction

Key studies have looked at the many reasons why some students have gained educational success due to the Micro Spiral Method. How do these students learn and apply what they learn? What are the factors that make a student achieve lasting learning outcomes, and how best can educators, particularly in science education, tap into the factors that help students learn and retain information at an accelerated rate?

The MSM approach is based on over forty years of research on cognitive science teaching and constructivism. The field of cognitive science has undergone a revolution in the development of powerful research tools and methodologies to investigate the processes of thinking and learning and the development of competence (Brown, 2000). The MSM approach to teaching and learning has been developed in recent decades based on constructivism and cognitive science research on teaching, learning, and problem-solving.

However, few university teachers have had the opportunity to acquaint themselves with the findings of this research or to consider deeply the question of how students learn. University faculty often are not informed about or consistent in using the constructivist model for teaching, albeit they use the constructivist approach throughout aspects of their scientific research (McNeil, 2007). According to the literature, the traditional nature of teaching relies on a "transmissionist" model of teaching. In this model, teachers hold the pedagogical misconception that: Students are blank slates—their previous science "knowledge" is irrelevant. Knowledge is binary - students either know something or they do not, and partial or incomplete understanding does not occur. Students are motivated, and independent, are self-teachers, and are willing to do it. Any departure from this ideal is the fault of the student. Students pay attention to how they learn and can learn from their mistakes; and scientific, rational thought is natural and obvious students engage in it without explicit instruction.

A case in point is that these teaching and learning misconceptions persist within university science faculty teaching primarily due to how scientists are prepared during graduate school. There is little emphasis placed on teaching and learning. For instance, in teaching science, most emphasis is placed on conducting laboratory research. However, research on learning reveals important principles for structuring learning experiences that enable instructors to move away from the transmission model approach to understanding that people use what they have already known when they are in new learning situations. Basic cognitive or learning sciences research provides empirical evidence of such in the form of problem or project-based learning.

The MSM Multiplication Factor

The Micro-Spiral Methodology (MSM) is an innovative instructional approach where educators blend recursive teaching with inquiry-based instructional strategies (Davis, 2015, 2017, 2019). This neuroscience- informed approach to teaching (Leaf, 2016) emphasizes the neurological process of storing (learning) and retrieving (using) information. Equipping Pre-service and In-service educators with the needed tools to implement MSM into the K12 teacher education program has and will continue to advance knowledge as well as benefit future educators and students in the STEM area (Buja, 2019, Fried & Amit, 2005). Curriculum designers have used the spiral approach for years to deepen students' knowledge of scientific and mathematical concepts and to bring students to higher levels of abstraction.

Broader impacts include teaching university faculty about learning progressions who are then able to produce knowledgeable, literate and critical thinking for pre-service, in-service, and especially middle school teachers who understand learning progressions through the process of a Micro-Spiral Method and integrating cutting-edge concepts into their courses. Expanding MSM programs in Education will deliver a strategic multidimensional solution to impact teachers, and especially middle school teacher preparation curricula, and professional development activities and improve the number of students pursuing degrees, particularly in the much-needed STEM areas. The teacher education program will strengthen the content knowledge as well as demonstrate the impact of the Multiplication Factor for all participants, which in turn will strengthen the concepts, knowledge, and skills of the students that they teach. The overarching goal of the MSM is to increase content knowledge and create critical thinkers as well as lifelong learners.

The Concept of a Micro-Spiral Curriculum

The concept of a Micro-Spiral curriculum is one in which there is an iterative revisiting of concepts, subjects, or themes throughout the course. A review of the literature revealed that few studies exist on increasing science achievement using a spiral curriculum. Wineland and Stephens (1995) conducted a study on the impact of a spiral curriculum on the science performance of 8th and 9th-grade students. The eighth graders who were tested using the spiral method scored significantly higher than the control group in a basic mathematics course. The ninth graders who were tested using the spiral method scored significantly higher than the control group on pre-algebra assessments (Wineland & Stephens, 1995). In another study, DiBiasio, Clark, Comparini and O'Connor (1999) evaluated a spiral chemical engineering curriculum. The open-ended project emphasized learning through engagement. The spiral curriculum reinforced students' understanding of the basic concepts and highlighted the concepts' interrelationships.

The Micro-Spiral Approach

A requisite paradigm shift involves adopting an approach that delves into comprehending the intrinsic nature of essential student skills, including the dynamic development of these skills over time. The imperative is to guide educators in adapting their instructional support to facilitate students' progression toward mastery. Central to this approach is an emphasis on learning progressions—the educational journeys undertaken by students as they advance towards skill mastery in specific domains, as opposed to focusing solely on outcomes measured by standardized test scores.

The actions undertaken to support empirical learning progressions for 21st-century skills bear substantial and urgent implications for the future populace. This responsibility falls on the shoulders of educators, funding bodies, education-focused nonprofits, and today's adults. The Micro Spiral teaching method stands out as a proven and

time-tested pedagogical approach. Employing Micro-Spiral Learning enhances students' confidence, enabling them to retain more information and master acquired knowledge, ultimately fostering improved academic performance.

The pivotal role of teaching and learning in shaping nations prompts consideration of an essential question: how can science, technology, engineering, and mathematics (STEM) be effectively imparted to future scientists, technologists, engineers, mathematicians, and STEM educators? The answer lies in the Micro-Spiral Methodology—a progressive approach to learning. Each iteration of this method adds layers of depth and understanding to knowledge and skills. The encoded concepts activate both hemispheres of the brain, securing their place in long-term memory through a mnemonic retrieval mechanism.

The answer is the Micro-Spiral Methodology, a spiral way of learning. Each iteration of this method adds another level of depth and understanding of knowledge and skills. The concepts are encoded on both the right and left sides of the brain and stored in long-term memory with a pneumonic retrieval mechanism. Scientific test results underscore the efficacy of the Micro-Spiral Methodology, demonstrating the compression of an entire year's curricula into a mere three months. Notably, Micro-Spiralled African American state science test scores experienced a remarkable 45 percent increase, Hispanic scores increased by 36 percent, economically disadvantaged scores rose by 32 percent, and Anglo scores saw a significant uptick of 28 percent. The compelling success of the Micro-Spiral Methodology attests to its effectiveness in accelerating learning outcomes across diverse student demographics.

The Micro-Spiral Method affects the students three-fold by: 1) introducing students to the concepts in knowledge and skills beginning in kindergarten up to the fifth grade. 2) mentoring the K- fifth-grade teacher on the use and implementation of the Micro-Spiral Method, which helps overcome absenteeism and loss of instructional time; and 3) assisting the middle school programs with one of the pre-service students who have been taught and certified in the Micro-Spiral Method, which will help overcome absenteeism and a loss of instructional time.

Methodology

The MSM approach to teaching has proven to sustain the engagement of students in their courses and to increase pre-service teachers' performance as they prepare to teach (Davis, 2015). MSM consists of three phases.

Phase one - The instructor elicits students' prior knowledge about a specific concept (e.g. from a previous course, set of experiences, or students' home cultural experiences). In Phase One, the instructor is accessing individual students' prior knowledge. Further, the instructor assesses students' existing schema or conceptual anchors. The assessment of prior knowledge is usually captured through the administration of pre-tests or students' responses to discrepant events or queries.

Phase two - The instructor extends the existing conceptual anchor. In the case where students maintain science misconceptions, the instructor provides a demonstration, reveals a discrepant phenomenon, or sets up a demonstration experiment or lab for students to test their current conception or engage in inquiry-based discourse to assist students in moving from a misconception to an accurate understanding of science concepts. During phase two, hands-on activities, assessments, and other instructional strategies are completed. These activities reinforce the science concept under consideration.

Phase three - Future concept is introduced. The Micro-Spiraling of concepts within the lesson progression layers new information to an existing conceptual framework. With institutional support and in collaboration with their geoscience peers, teacher education faculty can assess and build capacity to enhance, develop, and sustain essential and culturally relevant methods and practices shown to be influential in successful outcomes for K-12 and pre-service students (Walker 2017, Ladson-Billings 1995).

Table 1 5th Grade Science Scores only (Florida State Science Scores)

School Year	# of Students Enrolled	# of Students Earning Level 3 or above	% of Students Earning Level 3 or above
2022-2023	Unknown	Unknown	Unknown

2021-2022	36	15	42%
2020-2021	51	6	12%
2018-2019	35	11	31%
2017-2018	51	11	22%
2016-2017	35	8	24%
2015-2016	31	14	45%
2014-2015	24	12	50%

Specialized Training

The specific aim is to introduce the Micro-Spiral Methodology to educators and facilitate its implementation in their classrooms. Offering the Micro-Spiral Method Teach the Teacher model is instrumental in mitigating absenteeism and reducing the loss of instructional time. Moreover, this model aids in the encoding of concepts, knowledge, and skills into both hemispheres of the brain, thereby addressing some of the adverse effects on the educational system.

Education administrators play a crucial role in equipping teachers with professional development opportunities that enable the adoption of optimal learning methods. This involves instructing educators on effective strategies, techniques, and tips. The Micro-Spiral teaching strategies encompass learning how to teach recursive subject matter through inquiry-based instruction, the posing of questions, and purposefully connecting content to prior experiences.

The amplifying effect of the Micro-Spiral approach contributes to reinforcing institutional programmatic support capacity for curricula targeting both pre-service and in-service teachers. The utilization of the Micro-Spiral Method has been empirically proven to be a potent tool in enhancing students' test scores, underscoring its efficacy in educational settings.

This will increase teacher educators' awareness about the multiplication factor of the Micro-Spiral instructional approach. The educators learn to provide hands-on activities emphasizing the multiplication factor of the MSM and reflection sessions to equip college faculty in using the approach in their courses at the undergraduate level. While participating in the workshops, university faculty learn how to implement inquiry-based Micro-Spiral Methodology teaching strategies into pre-service teacher education programs.

A major goal is to disseminate the Micro-Spiral Methodology to pre-service teachers, in-service teachers, Higher Education Teachers, and other high-impact individuals who influence the education of K-16 students. Implementing the Teach the Teachers MSM Workshops, participants will be able to apply what they have learned to real-world problems they might face in their classrooms.

How the Spiral Curriculum Helps Minimize Gaps in Learning

The Micro-Spiraled Curriculum facilitates a gradual distribution of learning across time, creating intervals between the introduction of new concepts. This design enables students to solidify their understanding, engage in practice, and make improvements. After this revision and practice phase, more advanced and intricate content is introduced. Within a spiral curriculum framework, concepts are revisited multiple times, each instance involving a progressively higher level of complexity throughout the academic year.

The curriculum is mostly regarded as a logical progression of distinct skills and knowledge, providing the basis for future learning. In an ideal Micro Spiraled curriculum, students are acquainted with and taught the concepts and ideas in different grade levels in developmentally appropriate ways. A Micro Spiral curriculum is not simply the repetition of concepts taught but a deeper understanding of a concept with each successive encounter building on the previous encounter as life experiences do.

When learners re-engage with a concept over and over again, they recall prior knowledge in their memory and build on it. The Micro Spiral approach to teaching focuses on the open-ended nature of understanding. It demonstrates that learning never ends and is a lifelong process. The Micro Spiraled curriculum approach is widely considered an appropriate approach that leads to long-term learning for the students.

One of the key success factors of the Micro Spiral Method is that it creates learning environments in which everyone can thrive. This expands the outreach to a greater number of students, particularly those who have traditionally faced challenges in attaining success. It involves ensuring a high-quality education for all, including children with learning difficulties. Inclusive education advocates for providing education to every child within the same educational environment. It also extends its benefits to children from minority groups who have historically been marginalized.

Some of the early foundational work on memory was conducted in the late 1800s by German psychologist Hermann Ebbinghaus. He conducted a series of experiments on himself, involving the testing of his learning and retention of nonsensical words. In 1885, he published a book, later translated into English in 1913, reporting the results of his experiments. Ebbinghaus introduced the concept of a "forgetting curve" in this book, illustrating the exponential rate at which new knowledge is forgotten after initial learning (Brown, Roediger, & McDaniel, 2014). Ebbinghaus's research, along with subsequent decades of studies, demonstrates that approximately 70% of information read or heard is quickly forgotten, while the remaining 30% is forgotten at a slower pace (Brown, Roediger, & McDaniel, 2014).

Fortunately, cognitive psychologists, building on Ebbinghaus's work, have identified strategies to disrupt the forgetting curve and enhance learning outcomes. A well-supported approach backed by research is the "spiral" or "spaced" learning method. The U.S. Department of Education's Institute of Educational Sciences recommends "Space learning over time" as a fundamental principle for teachers to consider in their instructional planning (Pashler et al., 2007).

The Multiplication Factor of the Micro-Spiral Methodology (MSM) contributes to increased retention, as evidenced by studies measuring the progression and impacts of the MSM. An illustrative example of its impact emerged when it was observed that students had successfully transmitted their knowledge of geoscience concepts to younger siblings. These younger siblings, exposed to geoscience information at home, entered their classrooms already predisposed to the subject, displaying an enthusiastic desire to learn more after a few years.

Achieving Lasting Learning Outcomes

Lasting learning can occur only when there is meaningful engagement. Without engagement, there is no deep learning, real attainment, or quality progress. An effective way to create an inclusive setting is to present activities and tasks in a way that facilitates cooperative learning. When students learn in groups, everyone in the class gets the opportunity to participate. While planning group work, the teacher may create fair groups rather than asking students to pick themselves. Cooperative learning provides an opportunity for the students to express their feelings more freely, receive constructive and useful feedback, and offer better opportunities to respond.

The Micro-Spiral Method (MSM) Workshop, sponsored by the National Science Foundation (NSF) May 9-10, 2019, trained over 200 pre-service, in-service, higher education, and educational stakeholders using the Micro-Spiral Method. The MSM Workshop NSF Final Report was well received. White House Secretary of Education Representative Dr. Leonard Hayes gave a good evaluation of the MSM Workshop. After the completion of the workshop, data came in concerning the rise in the state of Florida's science test scores. These were the schools where pre-service university students trained in the MSM were now employed as teachers. In addition, in 2018-19 Multiplication Factors of Micro-Spiral Methodology, scores went up by nine percent.

The MF (Micro-Spiral Methodology) Workshops are dedicated to expanding the pool of university educators by introducing an innovative tool that integrates the Multiplication Factors of Micro-Spiral Methodology (MSM) into the instruction of their undergraduate and graduate students. A specific goal is to offer an MSM workshop tailored to University Minority educators. The overarching aim of this initiative is to furnish proven strategies intended to enhance the preparation of pre-service teachers through hands-on MF MSM Teach the Teachers workshops.

The Micro-Spiral teaching strategies encompass instructing recursive subject learning through inquiry-based instruction, posing questions, and intentionally linking content to prior experiences. The multiplication factor inherent in the Micro-Spiral approach contributes to fortifying institutional, programmatic support capacity for

educators, specifically tailoring curricula for pre-service and in-service teachers. Empirical evidence demonstrates the effectiveness of the Micro-Spiral Method in enhancing students' test scores.

MSM workshops serve to heighten teacher educators' awareness of the multiplication factor inherent in the Micro-Spiral instructional approach. These workshops involve hands-on activities emphasizing the multiplication factor of the MSM, coupled with reflection sessions designed to empower college faculty to integrate the approach into their undergraduate courses. Throughout the workshop, university faculty acquired the skills to implement inquiry-based Micro-Spiral Methodology teaching strategies within pre-service teacher education programs.

MSM workshops equip participants with essential tools for integrating Micro-Spiral Methodology (MSM) into K-12 teacher education programs, aiming to advance knowledge and benefit future educators and students in the STEM field (Buja, 2019; Fried & Amit, 2005). The spiral approach has been employed by curriculum designers for years to enhance students' understanding of scientific and mathematical concepts, guiding them to higher levels of abstraction. The Micro-Spiral Pedagogies studies were primarily an exploratory research project that tackled the challenge posed by the United States of America, seeking ways to ensure all students have the opportunity to learn significant science, especially geosciences content. Beyond addressing this challenge, the Micro-Spiral Pedagogies project also confronted persistent issues in science education related to teacher quality and diversity.

Educational Significance

The Rationale for the Micro-Spiral Method: The examination of the Micro-Spiral Curriculum is situated against political influences on science education in the United States (US), underscoring the significance attributed to science education by recent presidents and government agencies. Science education standards and curriculum are shaped by the nation's political, economic, and sovereign needs, with scientific progress playing a pivotal role in preventing national decline. International, national, state, regional, and local science achievement data reveal gaps in the understanding of science among some US students upon entering high school.

Even with the implementation of necessary instructional practices, teachers face the challenge of aligning the existing curriculum with their instructional approaches. In comparison to conventional linear curricula prevalent in school science, Micro-Spiral Curricula offer a distinct advantage. The latter often falls short in addressing or challenging students' misconceptions or preconceptions about physical phenomena. Linear curricula follow a sequential presentation of concepts, taking the knowledge to be taught and building upon each concept block by block, with each concept assumed to interlock with the next. Mastery of preceding concepts becomes a prerequisite before progressing to the next.

References

1. American Association for the Advancement of Science. Benchmarks for science literacy. American Association for the Advancement of Science. New York, NY: Oxford University Press, 1993.
2. American Association for the Advancement of Science (AAAS), Science for all Americans. Washington, DC: 1994.
3. American Association for the Advancement of Science (AAAS), . Remarks on the Release of the NAEP 2000 Science Assessment Results by George D. Nelson, Ph.D., Director, Project 2061. 2001. http://www.project2061.org/about/press/a1011120.htm. (Accessed October 2006).
4. Ashton, P.T., and R Webb. Teachers' sense of efficacy: Toward an ecological model. Paper presented at the Annual Meeting of the American Educational Research Association. New York, NY: 1982.
5. Bandura, Albert. Self-efficacy: The Exercise of Control Psychological Review. 1997: 604.
6. Becker, Howard. Saul. Problems of inference and proof in participant observation. American Sociological Review, 23, 652-660: 1958.
7. Brown, P. C., Roediger III, H. L., & McDaniel, M. A. (2014). Make it stick. Harvard University Press.
8. Buja, L.M. Medical education today: all that glitters is not gold. BMC Med Education 19, 110 (2019) doi:10.1186/s12909-019-1535-9. 2019.
9. Bush, Seth D., Stevens, Michael T., Tanner, Kimberly D., and Williams, Kathy S., Science Advances 05 Jun 2019: Evolving roles of scientists as change agents in science education over a decade: SFES roles beyond discipline-based education research Vol. 5, no. 6, eaav6403. DOI: 10.1126/sciadv. aav6403 (2019).

10. Corbin, J., & Strauss, A. (1990). Grounded theory research: Procedures, canons, and evaluative criteria. Qualitative Sociology, 1990:13, 3-21.
11. Creswell, J. Qualitative Inquiry and Research Design; Choosing Among Five Traditions. London: Sage Publications, 1998.
12. Davis, Edith "How We Really Learn: The Micro-Spiral Methodology (MSM) ," Tate Publishing and Enterprises, LLC (2015): August 2015.
13. Davis, Edith "Micro Pedagogies: Implementing a Micro-spiral Science Curriculum Minorities," American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS) VOL 14, NO 1 (2015) VOLUME 14, ISSUE 1: (OCTOBER - 2015), ISSN (Print) 2313-4410, ISSN (Online) 2313-4402 © Global Society of Scientific Research Researchers.
14. Davis, Edith "Micro Pedagogies: Implementing a Micro-spiral Science Curriculum for Pre-service Teachers and Middle School Children Science Workshop," The International Journal of Science in Society (2013): August 2014.
15. Davis, Edith G. "A Study of the Effects of an Experimental Spiral Physics Curriculum Taught to Sixth Grade Girls and Boys," The International Journal of Science in Society (2010): August 2011.
16. Davis, Edith "Micro Pedagogies: Implementing a Micro-Spiral Science Curriculum for Middle School Children. The International Journal of Science In Society Volume 2. Champaign, Illinois, USA: 2007, 2011.
17. Debarger, Angela H., Penuel, William R., Moorthy, Savitha, Beauvineau, Yves, Kennedy Cathleen A, and Boscardin, Christy K. Investigating Purposeful Science Curriculum Adaptation as a Strategy to Improve Teaching and Learning Tallahassee, FL: https://doi.org/10.1002/sce.21249 (August 31, 2016).
18. DeBlasio, David, Clark, William M., Dixon, Anthony, Comparini, Lisa and O'Connor, Kevin. Evaluation of a spiral curriculum for engineering. IEEE. 29th ASEE/IEEE Frontiers in Education Conference, 1999. FIE '99. 29th Annual Publication 2, (12), 15-18. San Juan, Puerto Rico: 1999. http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=841657. (Accessed October 2006).
19. Forgione, Pascal. International Test Scores Poor U.S. Test Results Tied to Weak Curriculum. Excerpted from a speech by Pascal D. Forgione, Jr., Ph.D., U.S. Commissioner of Education Statistics. 1999. http://4Brevard.com/choice/international-test-scores.htm. (Accessed October 2006).
20. Gay, L.R., and P Airasian. Educational Research. Upper Saddle River, NJ: Merrill Prentice Hall, 2003.
21. Geological Society of America, 2012, Position paper: The Importance of Teaching Earth Science and The Multiplication Factor Of The Micro Spiral Methodology And Achieving Lasting Learning Outcomes
22. Glaser, Barney G., and Anselm Strauss. The Discovery of Grounded Theory: Strategies for Qualitative Inquiry. Chicago, IL: Aldine Publishing, 1967.
23. Leaf, Caroline "Who Switched Off My Brain," Thomas Nelson Inc; New edition (2009): November 2009.
24. Loveless, Tom. Lessons learned: What International Assessments Tell Us about Math Achievement. Brookings Institution Press, 2004: 6-14.
25. National Assessment Governing Board (NAGB), Mathematics framework for the 2003 national assessment of educational progress. Washington, DC: 2002.
26. National Assessment Governing Board (NAGB). 2001 Science framework for the 1996 and 2000 National Assessment of Educational Progress. Washington, DC: 2000.
27. National Center for Education Statistics (NCES), . National Assessment of Educational Progress (NAEP). Report in Brief, NAEP 1996 Trends in Academic. 1996, 2006.
28. National Science Board (NSB), Transformative Research Final Report and Background Materials. Arlington,VA:NationalScienceFoundation,1997 http://www.nsf.gov/nsb/documents/2007/tr_report.pdf. (Accessed January 2007).
29. National Science Board. 2018. Arlington, VA: National Science Foundation, Science and Engineering Indicators 2018.
30. National Science Foundation. 2020. Arlington, VA: National Science Foundation, Geoscience Opportunities for Leadership in Diversity - Expanding the Network (GOLD-EN) 2020. http://www.nsf.gov/pubs/2020/nsf20058/nsf20058.jsp.
31. Pashler, H., Bain, P., Bottge, B., Graesser, A., Koedinger, K., McDaniel, M., & Metcalfe, J. (2007). Organizing instruction and study to improve student learning (NCER 2007–2004). Washington, DC: National Center for Education Research, Institute of Education Sciences, U.S. Department of Education.
32. Patton, Michael Quinn. Qualitative Research and Evaluation Methods, (3rd ed.). Thousand Oaks: SAGE Publication, Inc., 2002.

33. Science of Research Council, "How People Learn: Brain, Mind, Experience, and School," (2000). Committee on Developments in the Science of Research Council: 2000.
34. Sleeter, Christine. Un-Standardizing Curriculum: Multicultural Teaching in Standards-Based Classrooms. Teachers College Press, 2005.
35. Star, Susan Leigh. Grounded Classification: Information Systems and Qualitative Research. Grounded Theory and Faceted Classification 1996. Presented at the Information Systems and Qualitative Research. Philadelphia, PA: 1996.
36. Wineland, J.N., and L Stephens. "Effects of spiral testing and review on retention and mathematical achievement for below-average eighth- and ninth-grade students." International Journal of Mathematical Education in Science and Technology. 26. no. 2 (1995): 490-495.
37. Whetten, David A. "What Constitutes a Theoretical Contribution?" Academy of Management Review. 14. (1989). Surname A, Surname B and Surname C 2015 Journal Name 37 074203, Surname A and Surname B 2009 Journal Name 23 544