Contextualized Learning Material (CLM) in Developing Conceptual Understanding of Grade 7 Mathematics

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Abstract: The primary objective of the study is to design a contextualized learning material in developing the conceptual understanding of Grade 7 students in Mathematics as a teacher support material in mastering the math concept "sets". The study is considered developmental and quasi-experimental or one group pre-test and posttest since it underwent three phases namely: planning, development, validation, and utilization. In the planning stage, the least learned skill (LLS) was identified based on the item analysis of the first grading quarterly test. From the LLS obtained, the researcher made one Contextualized Learning Material (CLM). The content experts rated the developed SIMs "very satisfactory" which means that they viewed the materials suitable and appropriate for students to master the competency. The usability experts on the other hand, rated the developed CLM "very satisfactory" which implied that they considered the CLM as teacher support material that can be used to master the Math 7 competency "sets". The result on the comparison using paired t-test between the students' pre-test and posttest scores which was tested at 0.05 level of significance indicated p= 0.000 which means that the null hypothesis is rejected. Thus, there is significant difference between the pre-test and posttest scores of the grade 7 students. Thus, CLM is effective in developing the conceptual understanding of the students on the competency "sets". It is then recommended that teachers may also develop more contextualized learning materials for other topics in Mathematics and for other subject areas to address the students' least learned skills.

Index Terms: Contextualized Learning Material, conceptual understanding, development, validation, utilization

1. INTRODUCTION

Mathematics is an essential part in our daily living. It is an academic subject that focuses on problems which includes analytical, computational and other mental process skills. Mathematics is one of the compulsory core subjects in primary and secondary levels of education. This is intended to improve the mathematical literacy, and steer the country towards economic growth and development (Tella, 2008).

It is universally acknowledged that math is tough, incomprehensible, and of little interest to some people. However, it is also the primary avenue for improving student's logical thinking and higher-order thinking skills.

Generally, it is an alarming observation among Filipino students that they are weak in mathematics according to the result of the Third International Mathematics and Science Study-Repeat (TIMSS-R, 2011). Thus, student's errors in mathematics education are not simply a consequence of ignorance, lack of knowledge and situational accidents most student's mistakes are not due to unsureness, carelessness, or unique situational conditions, as was assumed at the beginning of the behavioristic theory of education. Rather, student errors are the outcome or the product of previous experience in the mathematics classroom. Hence, the extensive remark that numerous children execute poorly in school mathematics put much effort for the necessity of improved instruction. Also, according to Diaz (2016) student's taking up higher mathematics lack the prerequisite knowledge and skills. More specifically, they lack conceptual knowledge in Mathematics.

This is in accordance with the statement of Killpatrick et al. (2001) who posited that conceptual understanding is needed by the students for learning mathematics successfully because it enables them to learn new ideas by connecting those ideas to what they already know. This connection helps them to remember, use, and reconstruct those ideas when they need them. Further, Killpatrick et al. (2001) added that students need conceptual understanding to support the mathematical concepts as a foundation in solving mathematical problem.

Nowadays, learning mathematics has been given the major focus of teachers' efforts. Different strategies and techniques are highlighted for the students to be mathematically proficient. The National Research Council (2001) stated that to be mathematically proficient, a student must have conceptual understanding that understands mathematical concepts, processes, and relations. Conceptual understanding allows a student to apply and perhaps adapt some acquired mathematical ideas to new situations such classroom setting.

At present, in the Philippine educational system, learning materials are highly regarded as tools for the improvement of students' achievement. Thus, Dahar (2011) stresses that the use of appropriate learning material has a strong relationship to the academic performance of secondary students. Barlis (2015) added that instructional materials play an important role in improving student's Mathematics achievement.

Contextualized Learning Material or CLM refers to a teaching support material introduced into the teaching methods to stimulate the activity of the students and thereby increased their level of understanding (Dy in Cubillas, 2018). It is deliberately planned, prepared and developed for teaching remediation for low achievers in the subject. It is commonly given after the regular classroom instruction to students who failed to understand the concepts of the subject matter of the day.

Hence, this study primarily aims to develop and validate a Contextualized Learning Material, and utilize it in the grade 7 classroom to ascertain its effectiveness in developing the conceptual understanding of the students in Mathematics 7. This is done since it is essential for students to master the Mathematics 7 competencies for them to further proceed to a higher grade level competencies as such concept is the focal feature of the K-12 curriculum called the spiral progression.

It is indeed important for Math teachers to focus on improving the students' achievement in Math in secondary schools for it creates an influential effect on their performance in college and their future careers.

2. LITERATURE

Centuries ago, there were a lot of students who have achieved mathematical knowledge— whether the basics of arithmetic computation or the difficulties of geometric theorems—with less understanding of the math content. In which it merely provides much effect on the student learning foundation on their approaching mathematics development that can hardly result to a fear of mathematics or known as mathematics anxiety. As explained by Beilock et al., (2010), mathematics anxiety has an influence on student's mathematics success. He added that math anxiety in early age may cause a snowball effect that employs a cumulative price on math achievement by altering students' attitude and level of motivation towards math, increasing math avoidance, and eventually plummeting math competence.

Meanwhile, many students tried to create any kind of wisdom they could use as a method for the procedures such as adding common fractions or multiplying decimals. It is said that, attitudes toward mathematics are important due to the common relationship between attitudes towards mathematics and achievement in mathematics (Evans, 2007). No doubt many students observed underlying balances in the computations they were asked to accomplish. But frequently students' learning in Mathematics has often been more a matter of remembering than of understanding.

The extensive remark that numerous children execute poorly in school mathematics put much effort for the necessity of improved instruction. According to Killpatrick et al. (2001), conceptual understanding are needed by the students for learning mathematics successfully because it enables them to learn new ideas by connecting those ideas to what they already know. This connection helps them to remember, use, and reconstruct those ideas when they need them. They added that students need conceptual understanding to support the mathematical concepts as a foundation in solving mathematical problem.

Research endeavors persistently point out that early mathematical knowledge is linked with advanced proficiency achievement in mathematics, (Volume 46, Issue 5, of Developmental Psychology; Eccles, 2010) and may even be concomitant to the concerns of secondary graduation.

However, according to Szucs et al. (2016), most of the students have a mathematics anxiety and adults with math anxiety have problems with basic numerical processing (number sense), indicating that their performance was impaired at a very early stage. Mathematics anxiety is similarly distinct as a state of worry that occurs in facing with math-related circumstances (Zettle & Raines, 2002). It is an irrational unwillingness from mathematics often roots to the avoidance of the subject (Bursal & Paznokas, 2006). It has consistently been proven to weakening mathematics achievement (Peston, 2008). Initial math concepts such as knowledge of numbers and ordinality were the most dominant predictors of later learning, as being indicated by Romano et al. (2010).

Wang (2003) explained that the mastery of mathematics corresponds directly to each student's future and life, be it in the work force, college, or the military He added that mastery of basic mathematics skill better prepares one for higher level mathematics, which in turn develop students who are in college and career ready upon graduation of high school.

In addition, according to Brown & Quinn (2007), students who fail to master the foundation of conceptual understanding are often and able to conceptualize higher mathematics and commonly exhibit error patterns when learning higher mathematics.

Gathier, et.al (2004) emphasized that junior years are important time of transition and growth in students' mathematical thinking. Junior students begin to investigate increasingly complex ideas, building their capacity to deal with more formal concept. Early mathematical skill predicts not only later mathematical achievement but also success in other domains. They recommend that providing children with prospects to play, discover by exploring, and encounter mathematical patterns and structures as they engage with mathematics in different ways will help them to develop and acquire certain foundation of mathematical understandings (Sarama & Clements, 2009).

Indeed, students' mathematical achievement in secondary schools has an influential effect on their performance in college and their future careers. Possessing a good foundation in mathematics aids students to develop sophisticated perceptions and offers more future career opportunities. The significance of mathematical learning has frequently been highlighted by the educators and politicians (Wilkins & Ma, 2002). Mathematical knowledge is vital to educational and economic feats in modern society and is now gaining prominence in secondary student's mathematics achievement which forecasts tertiary admission and graduation, early career, income, and income's growth (National Mathematics Advisory Panel or INMAP, 2008).

According to Pink (2005) author of A Whole New Mind, people now live in the conceptual age which requires individuals to be able to critically think, solve problem, and adapt to new environment by utilizing transfer of ideas. In acquiring conceptual

understanding, the content must be taught and clearly illustrated in mathematical education in which the students would understand the concept rather than the procedure.

Moreover, the teacher's attitude towards mathematics and his/her approach in teaching mathematics is said to have an effect in student's learning, particularly in developing the conceptual understanding of the students. As stated by Evans (2007) attitudes towards mathematics are important since there is a reciprocal relationship between achievement in mathematics and attitudes towards the subject. Also, negative teacher attitudes toward mathematics often cause to avoidance of teaching strong mathematical content and influence students' attitudes and behaviors (Evans, 2011).

Hence, the teacher plays a vital role in enhancing the conceptual knowledge of the students by the pedagogical method of teaching that is applicable on the development of the child. Teachers should design instructional materials which will aid in the understanding of conceptual knowledge of students. It was viewed that instructional materials play a very important role in the teaching and learning-process. It enhances the memory level of the students. At this point in time that education has become prominent globally, oral teaching cannot just be the venue towards successful instruction, therefore the teacher has to be resourceful by utilizing learning materials to make teaching and learning process effective and fascinating (NIC hulls, 2003;Raw 2006)

Ibeneme (2000) described teaching materials as those used for sensible reasons such as demonstration in the class situation by the teachers and students. Oluwagbohunmi & Abdu-Raheen (2014) explained that teaching materials are used in order to help simplify explanations and make learning of subject matter comprehensible to students. In addition, (Ajayi & Ayodele, 2001) emphasized the significance of the availability of instructional materials in attaining effectiveness in the teaching and learning process and supervision in the school system.

Educators and policy makers are employing an increased emphasis on teaching the concepts and origin of problem-solving procedures (National Council of Teachers of Mathematics or NCTM, 2000), in expectations that increasing conceptual understanding will lead to better students' achievement particularly in Math.

At times, mathematics education scholars have used a more constrained description. Star (2005) noted that the term 'conceptual knowledge' has derived to incorporate not only what is known (knowledge of concepts) but also one way that concepts can be known (e.g. deeply and with rich connections). In which it shows that student's conceptual understanding affects the processes they use. Scholars made use of logic and proof to explain mathematical task and concepts and to design, defend, and evaluate arguments and solutions. Consequently, by engaging students into concepts, students learn mathematics by doing mathematics (NCTM, 2000)

According to Baroody, Feil, & Johnson (2007), conceptual knowledge must be distinct as 'knowledge about facts, generalizations, and principles, without requiring that the knowledge be richly connected. Empirical provision for this concept comes from research on conceptual change which demonstrates that beginners' conceptual knowledge is frequently fragmented and desires to be integrated over the progression of learning and specialists' conceptual knowledge continues to increase and become better systematized (diSessa, Gillespie, & Esterly, 2004; Schneider & Stern, 2009).

At present, in the educational system of the Philippines, instructional materials are considered as tools for the low achievers to cope up with their peers. An example of IM is a Strategic Intervention Material or SIM which refers to a teaching aid introduced in the class to encourage the students to learn or master the skill they failed to learn in regular class. The use of IM for remediation may increase students' level of understanding (Dy in Cubillas, 2018). IM is strategically prepared and designed for teaching remediation for the least learned skills.

Teacher support materials like Strategic Intervention Materials (SIM) and Contextualized Learning Materials (CIM) is an instructional material suggested by the Department of Education to improve student's performance. Since it plays a very important role in the teaching-learning process, it enhances the memory level of the students and makes the teaching-learning process interesting (Nicholls, 2000; Raw, 2003).

According to Bunagan (2012) learning materials are meant to re-teach the least-mastered concepts and skills. These materials are given to students to help them master competency which they were not able to develop during a regular classroom setting.

The new pedagogical approaches can be difficult to implement. Many teachers are not experts in learning strategies, and many have not immersed themselves in the extensive literature in teaching and learning; teachers are experts in their disciplines, and many teach using traditional methods that reflect how students learn. However, alternatives like contextualization may provide more learning gains.

As stated by Nowotny (2001) contextualization is a way to promote socially and powerful knowledge, it provides a conceptual dimension to contextualization. Moltz (2010) explained that contextualization can be seen as a form of "deep learning" that comes about through linking ideas and concepts across courses. It is a teaching skills with direct reference to real world events and practices (Berns & Erickson, 2005)

By that, it is being concluded by Home-Start International (2002) that if students understood fully the concept of mathematics and developed conceptual knowledge in their secondary year then, there is a great possibility that their performance and achievement in mathematics will increase later on. Students' experiences in high school have a profound impact on their later social, emotional and cognitive development.

Hence, it is essential for students to learn and master the competencies in the early grade particularly in Math for one skill may be a pre-requisite to another. Thus, Math teachers should not just be equipped with teaching strategies and techniques but also they should be armed with appropriate instructional materials such as Contextualized Learning Materials which was given highlight in this study.

3. THEORETICAL FRAMEWORK

This study is framed based on Piaget's Constructivist Theory, Concept-First Theories and Vygotsky's Zone of Proximal Development.

Constructivism is a popular learning theory with a unique attention placed on the mental processes that construct meaning. The constructivism principles are grounded mainly on Piaget's assimilation and accommodation processes. The two processes are tools through which learning is achieved. It believes that learner's conceptual understanding affects the processes they use. Such copious theories of knowledge acquisition propose that procedure generation is founded on conceptual understanding (Gelman & Williams, 1997; Halford, 1993). Children are supposed to use their conceptual understanding to constrain procedure discovery and to adapt their current procedures to unique tasks (Gelman, et al., 1994).

Piaget explained that when students find difficulty with a certain concept, it is due to a very fast passage from the qualitative structure of the topic at hand (by simple logical reasoning) to the quantitative formulation (in the sense of weight, numbers, etc.); situations that can help the student in his or her pursuit for understanding is the source of active methods that permit him or her to discover instinctively and require that "new truths" be learned, re-explored or at least reconstructed by the student not simply told to him or her by the teacher (Piaget, 1968).

Another theory in which this study is anchored on is the Concept-First Theories Accordingly, in Concept-First Theories, students innately develop conceptual understanding in a domain and then use this conceptual knowledge to generate and select procedures for solving problems in that domain (Geary, 1994; Gelman & Williams, 1993). Evidence consistent with the developmental precedence of conceptual knowledge has been found in mathematical domains ranging from simple arithmetic to proportional reasoning (Byrnes et. al., 1992). This theory and evidence have been used to justify reforms in mathematics education that focus on inculcating conceptual knowledge before teaching procedural knowledge (National Council of Teachers of Mathematics {NCTM}, 1989; Putnam, Healton, Pre-wat, & Remillard, 1992).

On the other hand, Vygotsky's Zone of Proximal Development or ZPD which states that students are particularly dependent on teacher's or peer's support .Scaffolding is the term given to describe the giving of appropriate help to a student in order for him or her to accomplish what by himself or herself would have been too difficult. Scaffolding is a back-up material that includes words and illustrations that can be seen and heard. It is an excellent way to provide comprehensible input to learners so that not only will they learn the essential subject content but also they will make progress in their acquisition of knowledge of the subject. This means that in designing learning materials, students should be able to see an image of what the teacher is describing or see the key words that the teacher is talking about for this not only aids in making the topic more comprehensible, but serves to remove the affective filter which brought about by the frustration, fear or boredom due to understanding very poorly in class (Cubillas, 2018).

Hence, theorists and researchers agree that in teaching Mathematics, teachers should develop in students conceptual understanding first prior to teaching procedural knowledge as implied in Concept-First Theories and Piaget's Constructivism theory and that they should design instructional materials which will aid to the enhancement of students' understanding towards the lesson as reflected in Vygotsky's ZPD.

4. Objectives of the Study

The main focus of this investigation is to develop and validate a Contextualized Learning Material (CLM) and ascertain its effectiveness. Specifically, the study aimed to:

1. identify the least-learned skill of the Grade 7 students in the first grading quarterly test;
2. determine the conceptualized learning material (CLM) which may be developed to master the least-learned skill;
3. evaluate the developed CLM in terms of its content and usability; and
4. compare the performance of the students in the pre-test (before CLM) and posttest (after CLM).

5. METHODOLOGY

A quasi-experimental one group pre-test and post-test design was administered to identify the development of conceptual understanding of Grade 7 Mathematics students. The design was employed mainly because of its strength which lies in the fact that advantages of each approach complements those of the other making a stronger research design that yields more valid and reliable findings (Opie 2004). The paired t-test (pre-test/posttest), was the main instrument used to ascertain the effectiveness of the developed and validated Contextualized Learning Material which was designed to help teachers provide the students appropriate aid to master the Mathematics competency.

For the development of the CLM, the researcher utilized the data as provided in the item analysis results by which the least learned skill was derived. While for the validation, both content and usability experts used the questionnaires adopted from study of Cubillas (2018) which consists of 20 items. Another researcher-made instrument was used in determining the effectiveness of the CLM which was validated by the three teacher-experts. It consists of 15 items about sets, its operations and its representation in Venn diagram. It underwent the reliability testing which resulted to 0.953 (Conbach's alpha) which means that the instrument is highly reliable. After the pre-test and posttest, the paired t-test was used to compare the students' performance. The t-test for dependent samples was used to determine if there is a significant difference between percentage scores in the pre-test and posttest of the group.

The study involved 64 students (32 female and 32 male) of Taligaman National High School who are enrolled in the School Year 2017-2018.

The developed and validated Contextualized Learning Material (CLM) contained five parts: the guide card, activity card, assessment card, enrichment card and reference card. The guide card stimulated the students' interest on the topic discussed and gave a preview of what they would learn. Activity card, assessment card, and enrichment card are series of activities with different level of difficulties to excite the students' interest as they answer the CLM. The reference card provides the students the list of sources of information which served as bases of the researcher in crafting the material.

6. RESULTS AND ANALYSES

1. The Least Learned Skill of the Grade 7 students in the First Grading Quarterly Test in Math

Viewed in Appendix A is the result of the item analysis in the first grading quarterly test of the grade 7 students in Mathematics. Item number 19 ranked the lowest with only 8 out of 32 or only 27 % of students answered the item correctly. This means that the students did far from the passing percentage of 75%. This further indicates that they failed to master the competency. Item no. 19 was about "set". The least learned skill then of the students in the first grading test is about "set". Hence, the result served as baseline of the researcher to develop a Contextualized Learning Material or CLM.

2. The Development of the Contextualized Learning Material (CLM)

The Contextualized Learning Material was developed based on the least- learned skill in the first grading quarterly test in Mathematics 7. It was framed based on Piaget's Theory of Constructivism, Concept-First Theories and by Vygotsky's Scaffolding Theory

The CLM was named ***Fun with Sets*** was designed using the Strategic Intervention Material (SIM) format which contain four parts called cards. The guide cards which stimulate the students' interest on the topic discussed and give a preview of what they would learn. The activity cards and the assessment cards which contain series of activities with different level of difficulties to excite the students' interest as they answer the CLM. Last is the reference card which provides the students the list of sources of information where they can source out ideas about sets.

In each card of the CLM, activities were designed in such a way that students will be able to understand the competency with or without the presence or assistance of the teacher. They were designed in progression in which the difficulty is gradually raised so that students will not bore or frustrate themselves in answering the material which may be due to material which is too easy or too hard for grade 7 students. Furthermore, each activity in the CLM was contextualized which means that the examples, tasks, items found in the material is relatable to the students.

3. The Validation of the Contextualized Learning Material

Viewed in the table is the mean distribution of the ratings given by the content experts.

Table 1. Content Validation of CLM

INDICATORS	Mean	INTERPRETATION
I. Objectives	4.70	Very Satisfactory
II. Technical Quality	4.85	Very Satisfactory
III. Instructional Quality	4.75	Very Satisfactory
IV. Organization	4.77	Very Satisfactory
V. Language Arts Content	4.74	Very Satisfactory
VI. Alignment	4.95	Very Satisfactory
GRAND MEAN	4.79	Very Satisfactory

As presented in Table 1, the alignment got 4.95, the highest mean rating given by the content experts which is interpreted as very satisfactory. The rating implies that the CLM has texts/words which are printed clearly, legibly, and written in size that is suitable for the students, its instructions are integrated with the students' prior knowledge or schema, its parts provide varied activities for the learners, its activity cards include in the lessons are congruent to the objectives listed in the guide card ,it is a useful resource in preparing students to meet the requirements of the curriculum standards and its activities have purpose, and are aligned to a skill or concept of the grade level. The lowest mean rating of the content experts is 4.70 under the indicator objectives which is interpreted as very satisfactory. The grand mean presented in Table 1 was 4.79 which is interpreted as very satisfactory. This result indicates that the CLM is suitable and appropriate for students to master the competency.

Table 2 presents the mean distribution of the ratings given by the usability experts. As presented, the highest mean rating given by the usability experts was 4.73 which was interpreted as very satisfactory for the ease of administration The result suggests that the instructions in every activity in the material are understandable. Another is that the answer keys for the activities in each material are provided. Also, the answers in each activity in the material are objective.

The lowest mean rating of the content experts was the time in answering the activities with a mean 4.50 which was interpreted as very satisfactory. This means that the students need enough time to accomplish the tasks in the CLM.

The grand mean presented in Table 2 was 4.61 which means that the CLM was viewed by the usability experts as very satisfactory. This result also indicates that the CLM as teacher support material can be used as a tool to master the Math 7 competency "sets".

Table 2. Usability Validation of CLM

INDICATORS	Mean	INTERPRETATION
I. Ease of Administration	4.73	Very Satisfactory
II. Ease of Scoring	4.70	Very Satisfactory
III. Expenses	4.55	Very Satisfactory
IV. Time	4.50	Very Satisfactory
V. Other Factors	4.59	Very Satisfactory
Grand Mean	4.61	Very Satisfactory

4. The Significant Difference between the Pre-test and Posttest Scores of the Grade 7 Math Students

Presented in Table 5 is the result of the paired T-test of the scores of the students in pre-test (Before CLM) and scores in the posttest (After CLM)

Table 5. Comparison of Means between the Pre-test and Post-test

	Mean Score	P-value[A,B]	Remark
Pre-test	5.70		
Post-test	9.70	0.000	Significant

[A]tested at 0.05 level of significance [B]tested using Paired T-Test

Table 3 shows the comparison of means between the pre-test and post-test scores of the students. It indicates the p=0.000 which means that the null hypothesis is rejected meaning there is a significant difference between the pre-test and post-test scores of the students. The result further manifests that there is an improvement of the students' performance after they were introduced with the CLM.

Soberano (2010) mentioned in his experimental study that appropriate instructional materials are effective in mastering the competency based on the mean gain scores in post-test. He found out that there was a positive transfer of learning in experimental groups. Thus, an instructional material such as CLM helps improve the student's performance.

6. CONCLUSIONS

The study primarily aimed to develop and validate a Contextualized Learning Material or CLM and to determine its effectiveness in mastering the least learned skill. The CLM was designed based on Piaget's Theory of Constructivism , Concept-First Theories, and Vygotsky's Scaffolding Theory of the ZPD or Zone of Proximal Development. The least learned skill of the grade 7 students in Mathematics is about "sets". This skill was used as the baseline in the development of the Contextualized Learning Material or CLM. The developed learning material contains five parts or cards. The guide card stimulates students' interest in accomplishing the tasks in the CLM and gives an overview of what are to be learned in the material. The activity and assessment cards which consist of series of activities with different level of difficulties to excite the students' interest as they answer the CLM and the reference card which provides the students the list of sources of information where they can source out ideas about sets.

The content experts considered the developed Contextualized Learning Material (CLM) as suitable and appropriate for the grade 7 students which aid them to master the least-learned competency in the first grading quarterly test. Also, the usability experts considered the developed CLM as a material that can be used as grade 7 teacher support material which are easy to administer and score.

In addition, the developed and validated CLM helps to improve the grade 7 students' scores. Thus, CLM is indeed an effective material which can be used by students to improve their performance in Mathematics.

7. REFERENCES

Brown, G., & Quinn, R. J. (2007). Fraction Proficiency and Success in Algebra: What Does Research Say?. *Australian Mathematics Teacher*, *63*(3), 23-30.

Bunagan F. (2012) http://www.slideshare.net/felixbunagan/strategic-intervention-material

Cubillas, T. (2018). Development and Validation of Strategic Intervention Materials (SIMs) in Teaching Elementary English 4: A Content Validation. Vol. 08, Issue, 06, pp.21252-21259, June, 2018. Retrieved from http://www.journalijdr.com on May16, 2018.

Dahar, M. (2011). Effect of the Availability and the Use of Instructional Material on Academic Performance of Students in Punjab Pakistan. Euro Journal Publishing Inc.

Dy, L. (2011). Teaching Physics through Strategic Intervention Materials. http://jhody.hubpages.com. Date Retrieved: March 06, 2015.

Evans, B. R. (2007). Student attitudes, conceptions, and achievement in introductory undergraduate college statistics. *The Mathematics Educator*, *17*(2), 24-30.

Gelman, R. & Meck, E. (1986). Preschoolers' counting: principles before skill. *Cognition*, *13*, 343–359. doi: 10.1016/0010-0277(83)90014-8.

Gelman, R. & Williams, E. M. (1997). Enabling constraints for cognitive development and learning: domain specificity and epigenesis. In D. Kuhn R. S. Siegler (Eds), *Handbook of Child Psychology: Cognition, Perception, and Language* (5th edn, Vol. 2, pp. 575–630). New York: John Wiley.

National Council of Teachers of Mathematics. (2000). Principles and Standards for School Mathematics executive summary. Reston, VA: NCTM.

Piaget, J. and Inhelder, B. *The Psychology of the Child*. New York: Basic Books, 1969.

Pink, D.H.(2005). A Whole New Mind: Why Right-brainers Will Rule the Future. 56755886, Riverhead Books.

Schneider, M. & Stern, E. (2009). The inverse relation of addition and subtraction: a knowledge integration perspective. *Mathematical Thinking and Learning*, *11*, 92101. doi: 10.1080/10986060802584012.

Siegler, R. S. & Crowley, K. (1994). Constraints on learning in nonprivileged domains. *Cognitive Psychology*, *27*, 194–226. doi: 10.1006/cogp.1994.1016.

Siegler, R. S. (1976). Three aspects of cognitive development. Cognitive Psychology,481 520.

Siegler, R.S., & Crowley, K. (1994). Constraints on learning in nonprivileged domains. Cognitive Psychology, 27, 194-226.

Star, J. R. (2005). Reconceptualizing procedural knowledge. *Journal for Research in Mathematics Education*, *36*, 404–411

Vygotsky, L. S. Mind in Society: The Development of the Higher Psychological Processes. Cambridge, MA: The Harvard University Press, 1978. (Originally published in 1930 by Oxford University Press.)

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