A STUDY OF LEARNING OUTCOME OF INNOVATIVE APPROACH IN TEACHING MATHEMATICS IN PRIMARY STUDENTS

Chandrali Roy Chaudhury[1]

Suwattana Eamoraphan[2]

Abstract: The study was conducted to identify innovative approaches in teaching Mathematics in primary grades to achieve higher learning outcomes. The derivatives applied in the study range from the teacher manipulative to student motivation. The research objectives were to study the learning outcome of innovative approach in teaching mathematics in primary students and to observe the attitude of students towards learning.

The examined population was comprised of 33 students of primary grades from an International School in Thailand. The primary source of data is the student performance in the school prior to application of innovative approaches. The four different approaches, visual, hands on application, Media application and Project work were used to teach the students. The researcher wanted to observe the increase in the learning outcome. The research design was based on one group experimental design comprising of Pretest (O_1) and Posttest (O_2) results. The research instrument consist of, Continuous Comprehensive Evaluation and Periodical assessment to study the grades and Questionnaire to study the attitudes.

Findings in this research were reviewed by scope of deriving new teaching standards is evident, which can be pursued for future researches and developing strategies for teaching and conducting studies can thus be highly beneficial for learning outcomes. It was observed 42.4% students' performance greatly improved from B or C grade to A & A* grade. The students' response to the innovative approach was also highly encouraging as majority approved of them and it was observed, that students had improved Interest level and Participation after application of Innovative approaches.

Keywords: Innovative approach, Learning outcomes, primary students, Mathematics

Introduction

Mathematics is a remarkable invention of human thought, a purely logical construction independent of experience and yet the basis for our understanding of the laws of nature. Much of modern mathematics, beginning with the invention of calculus in the seventeenth century, was developed in a close interplay with discoveries in physics and other natural sciences. It is now generally recognized that the need for largely unsuccessful, that many academicians were forced to comment that mathematics is the subject matter.

Mathematics is increasing, as mathematics provides the appropriate tool for modeling and understanding complex phenomena in nature, technology, and society. In particular, modern computer technology has increased the need for mathematics, as well as the range of scientific problems for which mathematics is relevant.

To harness this curiosity during elementary school ages and to incorporate an understanding in math is vital since those children who fail to understand the basics of math invariably struggle later in their school years. It is essential to involve children in an understanding of math. This is not an attempt to address issues relating to the variety of definitions of "innovation", and the value judgments inherent in the usage. The most common assumption is that innovation is a deliberate process (or product, directed towards outcome, but not necessarily achieving) improvement, which may involve originality or adaptation. We shall return to some of these considerations, including innovation as generated by individuals and by systems, as distinct from "change", and as a response to different situations.

The next step here is to consider what the education largely accepts as innovations, as planned changes that either seeks to replace conventional or traditional teaching and learning processes, or, which involve entirely new processes, which respond to contextual factors rather than to intrinsic factors within teaching and learning. The researcher had used the traditional methodology for class instruction with adequate practice and learning sessions. The topics--requiring reinforcement and re-teaching went fine but the fresher and newer topics.

If the presentation of a lesson is too easy to follow, most of the class will not need to learn the new material on their own. They will have a certain degree of confidence in their new knowledge, and this will tend to stifle their intellectual pursuits. Students construct mathematical structures that are complex, abstract, and powerful actively in a, learning environment. In such a setting, they explore

[1] M.Ed. Candidate, Master Degree program in Curriculum and Instruction, Graduate School of education, Assumption University, Thailand

[2] Assoc. Prof., Graduate School of Education, Assumption University, Thailand

mathematical ideas by thinking, participating, and reflecting. They take the responsibility of completing assigned tasks and controlling and creating their own mathematical ideas.

Research Objective

1. To study the learning outcome of innovative approach in teaching mathematics to different grades.
2. To observe the change in the attitude of students towards learning.

Scope of the Study

The learning outcome of teaching mathematical concepts of Fractions and Graphs with applications like Visual learning, Hands on activity, Media application and Project based learning and Experimental plan.

Conceptual Framework

The primary mathematics standards consist of a content standard, an evaluation standard, and a fundamental of developmental methodology. The main purpose of mathematics standards is to evaluate the quality of work, which plans, implements and develops the mathematics curriculum. The curriculum is made for forming skilled, well-behaved, responsible, and creative citizen in society. The mathematics standards meet the minimum required knowledge, skills, and performances of children. These standards and a content framework are the guidelines for school curricula and textbooks. This confluence of environment and biology guarantees that mathematical ideas of number, graphs, geometry and the like are essential parts of children's cognitive apparatus. It is hard to see how children or adults could survive in the ordinary environment without basic intuitions of more, less, near, far, and the like.

Independent Variable

Dependent Variable

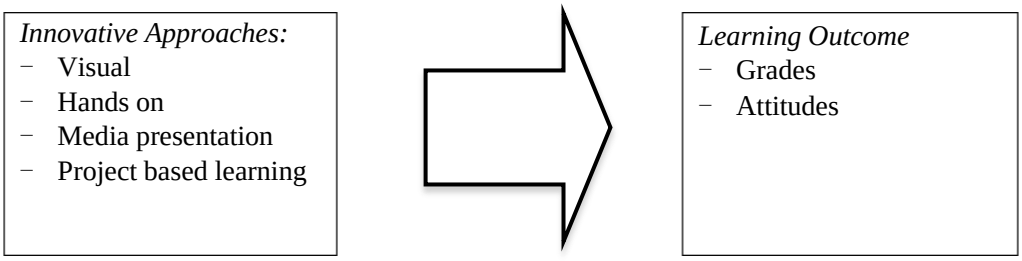

Figure 1: The Independent and Dependent Variables

Research Design

The researcher has used the "One group Experimental Design" test to bring out the comparison between learning outcomes of students in grade 2 and grade 3 before the application of innovative approaches and after. In this arrangement, students are presented with some type of treatment, e.g. the application of innovative teaching techniques and then the outcome measured is applied, such as class grades based on final summative evaluation. Like all experimental designs, the goal is to determine if the treatment had any effect on the outcome. The importance of experimental design also stems from the quest for inference about causes or relationships as opposed to simply description. Researchers are rarely satisfied to simply describe the events they observe. They want to make inferences about what produced, contributed to, or caused events.

Research Findings

Part I: Grades

The grading of the students shown in both the quarterly exam is divided in Continuous comprehensive evaluation that comprises of 40% of the grades earned and Periodical tests, which are taken at end of each unit or week to assess the learning outcome of the students.

The daily grading comprised of the class work, homework and participation is recorded minimum (A1) as the students were not involved as they should have been. The quantum of work completed in class was also below desired level. The results in periodical tests also reflected their discomfort in the subject (B1). However, when the same topics were addressed again in end of the quarter with innovative approaches, the result was dramatic. It accounted for full student attention and interest raising the (A2) to 97% and the periodical results in student performance rose to all time high at 92%. The best part observed at the end of the tabulation was the shift of majority students towards A* and A. The learning outcome derived was highest as it had the component of higher degree student involvement.

(See all tables in the last page)

The frequency of the performance of students is recorded as Pre- test and the last Quarter result is the Post-test.

Comparative study of Pre-test and Post Test

The under-mentioned table is the finding of my experimental process gathered after my post-test held in their final evaluation after 3 months. The pre-test was the standing of the grade 2 and 3 students before the application of innovative approaches on them. The observation is based on their performance and knowledge

The Table 2 records the consolidated score of student achievement after Pre-Test and Post-Test. The Pre-Test was held at the end of the first quarter in the month of June and the Post-test was the final evaluation held in April next year.

High learning outcome derived by positive shift in students' performance

The results reflect the student's higher learning outcomes derived with reinforcement and re teaching with innovative teaching skills done during months of April & May. The results clearly shows the increase in number of students achieving A* and A and more shifting of students from C and B

Table 3 shows the frequency and percentile of the students' improved performance from lower grade to higher grade. However, the noticeable improvement was with students with B grade earlier, with the innovative approach their grades changed to A after the posttest.

Part 2: Attitudes

The Questionnaire response consists of student reflection in assessing the content matter and approach and the emotional behavior. Most of students were strong in showing their choice amongst the four approaches. This is subjected to 3-grade scale. The students being too young the attitudes came out best in judging the approach YES & NO.

Score 3 meaning Disagree Symbol NO
Score 2 meaning Neutral Symbol Same as Before
Score 1 meaning Agree Symbol YES

A score of "1" means the researcher has been successful in applying the methods to enhance learning amongst students, while a score "3" means the researcher has failed to improve learning ability of the students. The Percentile gain reflects on the extent of progress felt by them.

Students' response based on the content matter and approaches

The students' assessed the content matter and approaches subject to preference and adaptability. The students with strong Visual & Musical intelligence tended to learn more from visual & media presentation. Those with strong Kinesthetic & Logical intelligence tended to opt for Hands on activity and those with strong intrapersonal and inter personal skills preferred the project work that based or group or cooperative activity. In the under mentioned table the student choices are classified into frequency and percentages.

Table 5 showed from students' perception, 11(33.3) of them benefitted from visual learning, 7(21.2) of them enjoyed the hands on activity, 5(15.2) learnt by audio visual and 7(21.2) learnt from projects. Therefore, the researcher perceived, most students learn by visual application.

Students' response based on their emotional characteristics

The questionnaire consisted of five different categories each signifying the level of learning and understanding. The characteristics of students are subject their attitude and emotional behavior.

Table 6 represents a summary of means, standard deviations, and interpretations of the students' behavior and characteristics from primary grades. The data clearly shows that the overall students' emotional characteristic was positive characters. It proves that they have responded well to the innovative approaches and had positive learning outcome.

Recommendation for Future Research

Recommendations for future research regarding innovative teaching methods are:

1. Teachers need to be given the opportunity to plan sequences of lessons where pupils experience a carefully developed progression of mathematical concepts and ideas, so that they develop as mathematical thinkers.
2. Interactive Whiteboards (IWBs) are becoming increasingly popular in primary classrooms. Some teachers feel that IWBs have had a positive impact on their planning and on pupils' motivation and learning.
3. Trying the fundamental of modeling or everyday Mathematics to be developed & practiced so that the teachers can use this as a tool for developing mathematical thinkers in their classrooms.
4. Mathematics lessons need to encourage good quality mathematical discussion through increased group and pair work and mathematically rich tasks.

Hence, It is essential that adequate guidance for teachers teaching in primary grades in the learning and teaching of mathematics to be consistent in their approach & requirements of teaching primary graders. This will ensure that young learners' interest in

mathematics is stimulated through appropriate experiences such as songs, games and meaningful and practical mathematical activities with minimal emphasis on whole-class teaching and teacher-directed activities leading to a better learning environment & higher learning outcome.

References

Anderson, J. R, Reder, Lynne M, Simon, H. A (1996). Applications *and Misapplications of Cognitive Psychology to Math Education.* Washington, D.C.: Brookings Institute Press.

Askew, M., Brown, M., Rhodes, V., Johnson, D., & William, D. (1997). *Effective teachers of numeracy*. London: School of Education, King's College.

Battista, M. T., & Clements, D. H. (1990). Constructivist Learning and Teaching. *Arithmetic Teacher* 34-35.

Ball, D. (1997). Developing Mathematics Reform: What Don't We Know About Teacher Learning—but Would Make Good Working Hypotheses. *In Reflecting on Our Work: NSF Teacher Enhancement in K–6 Mathematics,* edited by Susan N. Friel and George W. Bright. Lanham, Md.: University Press of America, 1997.

Blumenfeld, P., Soloway, E., Marx, R., Krajcik, J., Guzdial, M., & Palincsar, A. (2001). Motivating project-based learning: Sustaining the doing, Supporting the learning. *Educational Psychologist,* 26 (3 & 4), 369-398.

Bowman, B. T., Donovan, M. S., & Burns, M. S. (Eds.) (2001). *Eager to learn: Educating our preschoolers.* Washington, DC: National Academy Press.

Clements, D. H, Sarama, J & A. (2005). Engaging young children in Mathematics: Standards for early childhood mathematics education (pp. 377- 389) & Think math! S*cholastic Parent and Child*, 3(2), 25 Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Corcoran, T., McVay, S. & Riordan, K. (2003). "*Getting it right: The MISE approach to professional development".* Philadelphia, PA: Consortium for Policy Research in Education.

Darling-Hammond, L. (1996). Doing What Matters Most: Teaching for America's Future. New York: National Commission on Teaching and America's Future. *Studies of Excellence in Teacher Education*. AACTE.

Dewey, J. (1938*). Experience and education*. New York: Collier Books.

Eugene P. W. (1967). *Symmetries and Reflections – Scientific Essays of Eugene P. Wigner,* Indiana University Press, Bloomington, USA.

Franke, M., Carpenter, T. P., Linda, Levi and Elizabeth, Fennema. (1998). Capturing Teachers' Generative Growth: A Follow-up Study of Professional Development in Mathematics. *American Educational Research Journal.*

Fullan, M. (1993). *Change Forces: Probing the Depths of Educational Reform*. London: Falmer Press.

Gallistel, C. R., & Gelman, R. (2000). Non-verbal numerical cognition: From reals to integers. *Trends in Cognitive Sciences,* 4, 59–65.

Good, T. L., Grouws, D A. and Ebmeier, H. (1983). *Active Mathematics Teaching*. New York: Longman.

Groen, G., Resnick, L.B (1977). Can Preschool student invent addition? *Journal of Education psychology*, P 645- 652.

Handal, B. & Herrington, A. (2003). Mathematics teachers' beliefs and curriculum reform. *Mathematics Education Research Journal, 15*(1), 59-69.

Hargreaves, M., Shorrocks-Taylor, D., & Threlfall, J. (1998). Children's strategies with number patterns. *Educational Studies*, 24(3), 315–331.

Hiebert, J., Carpenter, T., Fennema, E., Fuson, K., Wearne, D., Murray, H., Oliver, A., & Human, P. (1997). The nature of classroom tasks. *In (author) Making sense: Teaching and learning mathematics with understanding*. Portsmouth, NH: Heinemann.

Mehan, H. (1979). *Learning lessons: Social organization in the classroom*. Cambridge: Harvard University Press.

Muijs, R. D. & Reynolds, D. (2000). *Effective Teaching, Evidence and Practice.* London: Paul Chapman.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, VA: National Council of Teachers of Mathematics.

Perry, B., Howard, P. & Tracey, D. (1999). Head mathematics teachers' beliefs about the learning and teaching of mathematics. *Mathematics Education Research Journal, 11*(1), 39-53.

Piaget, J. (1952). *The Origins of Intelligence in Children.* New York: International University Press. (Original work published 1936).

Prawat, R. (1992). Teachers' beliefs about teaching and learning: A constructivist perspective. *American Journal of Education*, 100, (354-395).

Snow-Renner, R. Lauer, P, Snow, D., Martin-Glenn, M., Van Buhler, R., & Stoutemyer, K., (2005). T*he influence of standards on K–12 teaching and student learning: A research synthesis.* Aurora,

CO: Mid-continent Research for Education and Learning.

Steffe, L & Gale, J (1995). *Constructivism in teaching.* Hillsdale, NJ, Erlbaum.

Supovitz, J. A. & Turner, H. M. (2000). The effects of professional development on science teaching practices and classroom culture. *Journal of Research in Science Teaching, 37*(9), 963-980.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press.

Wilson, S. & Berne, J. (1999). *Teacher learning and the acquisition of professional knowledge: An examination of research on contemporary professional development*. Washington, DC: American Educational Research Association.

Windschilt, M. (2002). Framing constructivism in practice as the negotiation of dilemmas: An analysis of the conceptual, pedagogical, cultural and political challenges facing teachers. *Review of Educational Research, 72*, 131-175.

Table 1: Gradation of Students in Pretest & Post Test in both Continuous Comprehensive Evaluation and Periodical Tests

Pretest

Months	CCE/40	Percentile (A1)	Periodicals/60	Percentile (B1)
April	14.5	36	22.5	37
May	12	30	22	37
June	20	50	29	48

Post test

Months	CCE/40	Percentile (A2)	Periodicals/60	Percentile (B2)
January	31.5	78	47	79
February	35	87	51.5	86
March	38.5	97	57.5	92

Table 2: Comparative Study of Student's Performance from Pre-Test to Post Test

Grade 2 &3	Outstanding (A*)	Excellent (A)	Good (B)	Average (C)	Total
Pre-test	5	9	10	9	33
Post-test	10	13	6	4	33

Table 3: Frequency and Percentage of Improved Student's Performance after the Effect of Innovative Approach for Primary Students

Grade	Frequency	Percentage
Grade A- A*	6	18.1
Grade B- A*	8	24.3
Grade B- A	14	42.4
Grade C- B	5	15.2
Total		100.0

Table 4: Response of Student to the Innovative Approach and Their Opinion on Their Learning Outcomes

Instruction	Focus	No. of students
Student Reflection	YES	27
	Same as before	3
	NO	3

Table 5: Frequency and Percentage of Students' Learning Outcome Derived on Application of Innovative Approaches

Variable	Frequency	Percentage
Visual learning	11	33.3
Hands on activity	7	21.2
Media application	5	15.2
Project based	7	21.2
Overall	33	100.0

Table 6: Means, Standard Deviations and Interpretations of Students' Responses after Applying Innovative Approaches

5 Items/art	Mean	SD	Interpretation
Interest level	4.11	103	Good
Self-motivation	4.02	214	Good
Awareness	4.03	120	Good
Participation	4.11	121	Good
Clarity and neatness	3.87	210	Good
Interpersonal skill	4.05	52	Good

Source: (GIS data collection)