

Developing Academic Achievement in Mathematics on Fractions through Active Learning Combined with Skill Practice for Grade 3 Elementary Students

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Abstract

This research aims to 1) develop an effective Active Learning plan combined with skill practice according to the 70/70 criterion, 2) study the learning achievement index through Active Learning combined with skill practice, and 3) investigate the satisfaction towards Active Learning combined with skill practice. The sample group consisted of 27 Grade 3 students from Muang Wapi Pathum School, during the first semester of the 2023 academic year, selected through purposive sampling. The research tools included 1) 10 Active Learning plans totaling 10 hours, 2) mathematics skill practice, 3) an achievement test consisting of 15 multiple-choice questions, and 4) a satisfaction questionnaire regarding Active Learning combined with skill practice, using a 5-point Likert scale with 13 items. The statistical analysis included mean, percentage, standard deviation, and effectiveness index.

The research found that the Active Learning plan was effective with an efficiency of 81.00/82.20, which meets the predefined criterion of 70/70. The effectiveness index was 0.6828, indicating that students improved their learning by 68.28 percent. Overall satisfaction was at the highest level, with an average score of 4.54.

Keywords: active learning, skill practice, learning achievement, satisfaction

1. Introduction

Mathematics is a branch of science that plays a vital role and is beneficial to human life because it is the science of thinking, and it is important for the development of brain potential in terms of thinking, reasoning, and systematically solving problems (Suwan Kanjanamayoon and others, 2012: 1). Studying mathematics is not just a key to developing learning to make learners think rationally, but mathematics also has significance for studying various subjects in the contemporary world. In today's rapidly changing world, a society that relies on advanced technology, an individual must have the ability in systems thinking, critical thinking, analytical thinking, logical thinking, problem-solving, and decision-making, which all require knowledge from the subject of mathematics. Therefore, mathematics is a subject of great importance to all learners.

The mathematics learning area curriculum, according to the Basic Education Core Curriculum B.E. 2551 (2008) (revised edition B.E. 2560 (2017)), establishes frameworks, content standards, learning standards, and indicators by grade level as criteria for determining the quality of learners upon graduation. It comprises three main content areas: Numbers and Algebra, Measurement and Geometry, Statistics and Probability. Mathematics instruction in classrooms aims to impart mathematical knowledge that emphasizes content and the process or methodology that the instructor exemplifies or demonstrates. Teaching is directed towards developing mathematical skills and processes that can be applied in simple, relatable situations, to allow learners to see the value and benefits of the subject. Despite the recognized importance of these points, the appreciation and utility of mathematics have not been as widespread as they should be. However, the development of mathematics teaching and learning has increasingly moved in this direction (Institute for the Promotion of Teaching Science and Technology, 2017).

Applying mathematics in daily life serves as a foundation for higher-level studies. Moreover, mathematics helps develop an individual's potential to become a well-rounded person, enhancing rationality, thoughtfulness, creativity, organized thinking, planning skills, responsibility for assigned tasks, and problem-solving ability (Niyusorn Amara and Siriporn Tipkong, 2014: 17). Therefore, students need to develop their mathematical

knowledge to understand and become well-rounded humans with physical, mental, intellectual, and emotional balance, capable of thinking, acting, solving problems, and living harmoniously with others in happiness.

However, from the external quality assessment of educational institutions by the Office for National Education Standards and Quality Assessment (Public Organization), it was found that in terms of student quality development, 65% of basic educational institutions did not meet the assessment criteria of ONESQA from the first round of external assessment, out of more than thirty thousand institutions nationwide. In terms of learner quality, it was found that the achievement in core subjects such as English, Mathematics, Science, and Social Studies averaged below 50% (Office of the Education Council, 2009). Standard 4, which is the ability of learners to think analytically, critically, creatively, and reflectively, is mostly in the improvement level from the last ONESQA assessment summary from 17,562 institutions, with only 11.1% of institutions being rated as good (with 75% of students and above) (Office of Academic Affairs and Educational Standards, 2006).

Active Learning management is a process aligned with the constructivist approach, which emphasizes learning processes more than subject matter content. Its aim is to help learners make connections or generate knowledge within themselves through hands-on practice via media or learning activities, with teachers acting as facilitators, motivators, or providers of convenience to stimulate learning. Learners engage in higher-order thinking processes, including analysis, synthesis, and evaluation of what they have gained from learning activities, making learning meaningful and applicable to other situations effectively. Active Learning is a learning process in which learners actively engage and apply thinking processes to what they have done (Bonwell and James, 1991). Learners transition from being knowledge recipients to active participants in knowledge creation. It can be observed that the Active Learning approach is an effective way of managing learning that provides guidelines to address educational management challenges in coping with changes in the 21st century. Active Learning management focuses on empowering learners to take on a role in self-directed learning or, in other words, being participants in knowledge creation, rather than merely learning through receiving information from teachers. This aligns with Gifkins (2015), who defines Active Learning as engaging learners in learning activities related to various content formats to stimulate thinking. According to Meyers and Jones (1993:6), important components of Active Learning include speaking, listening, reading, writing, and reflecting. Implementing Active Learning management is thus a process where learners actively practice and apply thinking processes to what they have done (Merrill Harmin and Melanie Toth, 2006; Schmidt, 1993;), leading to sustainable learning outcomes.

Based on the above concept, it has been recognized that teaching methods are crucial in fostering the development of academic achievement in mathematics. Therefore, the choice was made to organize learning on the topic of fractions in mathematics through active learning combined with skill practice for Grade 3 elementary education.

2. Objectives of the Study

The objectives of the research are: to study the efficiency of learning management on the topic of fractions through Active Learning combined with skill practice for Grade 3 elementary students, according to the 70/70 criterion., To investigate the learning achievement index, and to explore the satisfaction of students towards learning management.

3. Method

3.1 Population and Sample

Population and Sample 1.1 The population for this research includes Grade 3 students of the 2023 academic year at Muang Wapi Pathum School, under the Primary Educational Service Area Office, Mahasarakham District 2, totaling 7 classrooms and 206 students. 1.2 The sample used in this research consists of students from Grade 3, room 4 of the 2023 academic year at Muang Wapi Pathum School, under the Primary Educational Service Area Office, Mahasarakham District 2, totaling 27 students, selected through purposive sampling.

3.2 Research Instruments

Research Instruments 2.1 Learning management plans, totaling 10 plans. 2.2 Mathematics skill practice on the topic of fractions for Grade 3 students. 2.3 An achievement test on the topic of fractions in mathematics for Grade 3, consisting of 15 items, in the form of multiple-choice questions. 2.4 A satisfaction questionnaire regarding Active Learning combined with skill practice on the topic of fractions in mathematics for Grade 3, structured as a 5-level Likert scale, consisting of 13 items, with all 13 items required for the actual survey. The tools used in all types of research undergo quality checks by experts and are then refined and adjusted according to suggestions and recommendations.

3.3 Data Analysis

To determine the efficiency of the learning management plan on the topic of fractions in mathematics through Active Learning combined with skill practice for Grade 3 students, achieving the 70/70 criterion using basic statistical measures including percentage, mean, standard deviation, and value calculation.

To calculate the learning achievement index (Effectiveness Index: E.I.) on the topic of fractions in mathematics through Active Learning combined with skill practice for Grade 3 students using basic statistical measures.

To analyze the satisfaction towards Active Learning combined with skill practice for Grade 3 students using basic statistical measures, including mean and standard deviation.

4. Results

The Results of A Study Present in Tables 1-3

Table 1. Efficiency of the Active Learning Plan Combined with Skill Practice on the Topic of Fractions for Grade 3 Elementary Students

Learning Outcome	Maximum Score	Mean (\bar{x})	S.D.	Average Percentage Score
Process Efficiency	175	141.57	2.68	81.00%
Outcome Efficiency	15	12.33	1.47	82.20%

From Table 1, it is found that the efficiency of the learning management plan through Active Learning combined with skill practice, the process efficiency (E1) equals 81.00, and the outcome efficiency (E2) equals 82.20, or the efficiency is 81.00/82.20.

Table 2. Analysis of the Learning Effectiveness Index through Active Learning Combined with Skill Practice on the Topic of Fractions in Mathematics for Grade 3 Elementary Students

Number of Students	Maximum Score	Total Score Before Learning	Total Score After Learning	Effectiveness Index (E.I.)
27	15	178	333	0.6828

From Table 2, it is found that the analysis of the learning effectiveness index through Active Learning combined with skill practice on the topic of fractions in mathematics for Grade 3 elementary students resulted in an effectiveness index of 0.6828. This indicates that students made a learning progress increase of 68.28 percent.

Table 3. Average and Standard Deviation of Student Satisfaction with Active Learning Combined with Skill Practice on the Topic of Fractions in Mathematics for Grade 3 Elementary Students

Item	Evaluation Item	Mean (\bar{x})	S.D.	Satisfaction Level
1	Presentation of content is well-organized	4.19	0.68	High
2	Students can summarize key points	4.59	0.57	Highest
3	Students participate in learning activities	4.81	0.56	Highest
4	Students have increased interest and enthusiasm in learning	4.70	0.61	Highest
5	Sequencing of activities facilitates student learning	4.48	0.64	High
6	Teaching media helps students understand lessons easily and learn faster	4.48	0.64	High
7	Teaching media makes lessons more interesting and valuable for students	4.48	0.64	High
8	Knowledge gained from learning can be applied in daily life	4.59	0.64	Highest
9	Students enjoy learning and participating in activities	4.59	0.64	Highest
10	This teaching activity helps students think systematically	4.48	0.58	High
11	Students enjoy seeking additional knowledge to find answers	4.19	0.68	High
12	This teaching activity helps students make rational decisions	4.59	0.57	Highest
13	This teaching activity promotes creative and innovative thinking in students	4.81	0.56	Highest
Overall		4.54	0.62	Highest

From Table 3, it is found that students are highly satisfied with the Active Learning approach combined with

skill practice on the topic of fractions in mathematics for Grade 3 elementary students, with an overall average of 4.54, categorized at the "Highest" level of satisfaction.

5. Conclusion

The learning management plan on the topic of fractions in mathematics through Active Learning combined with skill practice for Grade 3 students was developed and found to have an efficiency of 81.00/82.20, which meets the predefined criterion of 70/70. The Active Learning approach combined with skill practice on the topic of fractions in mathematics for Grade 3 students resulted in an effectiveness index of 0.6828, indicating that students experienced a learning progress increase of 68.25 percent. Students expressed high satisfaction with the Active Learning approach combined with skill practice on the topic of fractions in mathematics for Grade 3 students, with an overall average rating of 4.54, categorized as "highest level" of satisfaction.

6. Discussion

Active Learning combined with skill practice for Grade 3 students showed an effectiveness of the learning management plan of 81.00/82.20, which means the process effectiveness, derived from the scores during the skill practice, is 81.00 percent, and the outcome effectiveness, from the post-learning achievement scores, is 82.20 percent. This demonstrates that the learning plan on the topic of fractions in mathematics through Active Learning combined with skill practice for Grade 3 students is effective according to the 70/70 criterion set.

It was observed that the process effectiveness was higher than the outcome effectiveness. This is because Active Learning combined with skill practice emphasizes student-centered learning, encouraging students to actively engage, practice, and create knowledge from the skill practice, aligning with Chaiyos Ruengsuwan (2010), who stated that Active Learning characteristics include: Developing brain potential such as thinking, problem-solving, and applying knowledge; Allowing maximum student participation in the learning process; Students constructing knowledge and organizing the learning process themselves; Involving students in knowledge creation, interaction, and collaboration rather than competition; Teaching students shared responsibility, work discipline, and task division; Creating scenarios for students to read, speak, listen, and think deeply, with students organizing their learning system; Emphasizing high-level thinking skills activities; Providing opportunities for students to integrate information, data, and critical thinking principles; The teacher facilitating the learning process for students to act independently; Knowledge arising from experience, knowledge creation, and student reflection.

This aligns with the research by Wanakphon Chomchueun, Somwong Plaengprasopchok, and Krisana Sokhumma (2022) on Active Learning in the topics of ratios, proportions, and percentages for Grade 7 students, showing significant statistical improvement in mathematics achievement after learning, and with the study by Chadaporn Jekruay (2022) on developing learning activity sets for Thai language topics of leading consonants and cluster words for Grade 3 students combined with Active Learning, finding effectiveness of 89.71/89.13. Additionally, Suparat Phansopa (2022) studied the learning outcomes in the mathematics topic of Time for Grade 4 students using cooperative learning with Team Pair Solo technique, finding significant statistical improvement in post-learning achievement.

The Active Learning approach combined with skill practice on the topic of fractions in mathematics for Grade 3 students resulted in an effectiveness index of 0.6828, indicating that students experienced an increase in learning progress by 68.28 percent. This may be attributed to the researcher's implementation of Active Learning combined with skill practice, which focuses on student-centered learning, encouraging hands-on practice and knowledge creation by the students themselves from the skill practices. This approach leads to durable learning outcomes, as students gain true understanding and knowledge of the subject matter, thereby improving their mathematics achievement. This is consistent with Sathapon Praditkun (2015), who mentioned that it is a learning management process based on Constructivism, emphasizing the learning process over content to help students link or create knowledge within themselves through practical engagement with media or learning activities, guided by teachers who stimulate, advise, or facilitate, leading to meaningful learning and application in various situations. This aligns with the research by Chadaporn Jekruay (2022) on developing learning activity sets for the Thai language topics of leading consonants and cluster words for Grade 3 students combined with Active Learning, finding an effectiveness index of 0.6778, indicating that students significantly improved their learning progress by 67.78 percent.

Students showed the highest level of satisfaction with the Active Learning approach combined with skill practice on the topic of fractions in mathematics for Grade 3 students, with an overall average of 4.86. This high level of satisfaction may be due to the researcher's implementation of Active Learning combined with skill practice, which included engaging activities and instructional media that made the lessons more interesting and valuable to students. The instructional media facilitated easier and quicker understanding of the lessons, increasing

students' interest and enthusiasm for learning. This aligns with Prakarn Anuphasanayakorn (2013), who stated that students' feelings are crucial for learning because their emotions and attitudes influence the learning process. Effective learning occurs when students are motivated and have a positive attitude towards what they are learning. Therefore, the learning environment is essential. This is consistent with the research by Veerayut Duangyai (2023), who studied mathematics learning to develop analytical and problem-solving skills using Active Learning for Grade 8 students. The study found that overall satisfaction with mathematics learning was high, and the activities that allowed students to participate in hands-on practice together were the most satisfying. This matches the research by Chadaporn Jekruay (2022) on developing learning activity sets for Thai language topics of leading consonants and cluster words for Grade 3 students combined with Active Learning, which found that the overall satisfaction with the learning activities was at the highest level, and upon examining each item, students were most satisfied with every aspect.

7. Research Suggestions

7.1 These are the Suggestions from the Study

Active Learning should be learner-centered. During the activity planning phase, it's essential to consider the readiness and different foundational knowledge levels of students. Teachers must understand the individual differences among students. To enhance the effectiveness of the learning activities, teachers should create opportunities for students to learn independently and encourage peer learning within the group, acting primarily as facilitators. In Active Learning, teachers should stimulate each student to think, analyze, and synthesize independently. Learning should come from hands-on practice and exchanging knowledge with peers in the classroom. The primary role of the teacher is to suggest, support ideas, and pose questions that maximize learning opportunities. Active Learning is suitable for certain content areas only. It's advisable to use a variety of activities or learning methods for the same topic to increase student interest. The steps for implementing Active Learning should be clearly explained for mutual understanding. Active Learning combined with skill practice sometimes focuses on creating activities for independent learning and promotes the practice of mathematical skills through regular exercises, which might lead to boredom during practice sessions. To develop students' skills, it's beneficial to integrate more real-life problems or situations related to daily life to highlight the importance of mathematics. In Active Learning, teachers should be flexible with time, allowing students to think and create knowledge independently, and adjust the duration of activities to be more appropriate. Teachers should incorporate more real-life problem-solving scenarios into skill practice exercises to enhance the application of knowledge.

7.2 Future Research Recommendation

1) Future studies should explore the use of Active Learning in other mathematical content areas. 2) There should be research on the use of Active Learning related to other mathematical process skills, such as problem-solving abilities, communication skills to express mathematical ideas, the ability to make connections, and other variables. 3) There should be a comparison of Active Learning combined with skill practice across different content areas and grade levels.

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Competing interests

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Data sharing statement

No additional data are available.

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References

- Bonwell, C., & James, A. E. (1991). *Active Learning; Creating Excitement in the Classroom*. ASHE-ERIC Higher Education Report No.1. Washington, D.C. The George Washington University, School of Education and Human Development.
- Chadaporn Jekruay. (2022). *Development of Learning Activity Sets on Leading Consonants and Cluster Words for Thai Language Learning Area for Grade 3 Students Combined with Active Learning*. Nonthaburi: Rajabhat Uttaradit University.
- Chaiyong Promwong. (2016). *Primary Education Teaching Sets*. Nonthaburi: Sukhothai Thammathirat Open University.
- Chawalit Chukamphaeng. (2010). *Curriculum Development and Teaching* (2nd ed.). Maha Sarakham: Mahasarakham University.
- Chaweewan Keeratikor. (1995). *Training Manual for Developing Primary Education Level Computational Thinking*. Bangkok: Chulalongkorn University.
- Department of Academic Affairs. (2002). *Basic Education Curriculum B.E. 2544 (2001) Manuals for Mathematics Learning Area Management*. Bangkok: Printing Organization of the Thailand Post and Parcel.
- Duran, P. A., Adam, J. C., Charity, W., Edgar, F., Geoff, P., & Laird, H. K. (2024). Student Attitudes and Achievement in Active Learning Calculus. *International Journal of Mathematical Education in Science and Technology*, 55(3), 759-780. <https://doi.org/10.1080/0020739X.2022.2150902>
- Gifkins, J. (2015). What Is 'Active Learning' and Why Is It Important?. *E-international relations*. Retrieved from <http://www.e-ir.info/2015/10/08/what-is-active-learning-and-why-is-it-important>
- Institute for the Promotion of Teaching Science and Technology. (2003). *Manual for Mathematics Assessment and Evaluation*. Bangkok: Srimuang Printing.
- Institute for the Promotion of Teaching Science and Technology. (2017). *Manual for Using the Mathematics Learning Area Curriculum (Revised 2017) According to the Basic Education Core Curriculum B.E. 2551 (2008) Secondary Education Level*. Bangkok: Institute for the Promotion of Teaching Science and Technology.
- Kamon Lomnaimueang. (2005). *Manual for Classroom Research Practice*. Kalasin: Prasan Printing.
- Kanyapak Thamsuk. (2022). *Development of Mathematical Problem-Solving Skills on Addition, Subtraction, Multiplication, and Division for Grade 2 Students*: Rajabhat Rambhaibarni University.
- Kusaya Sangdech. (2002). *Manual for Developing Learner-Centered Teaching Media for Primary Education*. Bangkok: Mac.
- Merrill Harmin and Melanie Toth.(2006). *Inspiring Active Learning: A Complete Handbook for Today's Teachers* Gale virtual reference library.
- Meyers, C. & Jones, T. (1993). *Promoting active learning: strategies for the college classroom*. San Francisco: Jossey-Bass.
- Ministry of Education. (2008). *Basic Education Core Curriculum B.E. 2551 (2008)*. Bangkok: Agricultural Cooperative Federation of Thailand Printing House.
- Nikom Chompuhong. (2011). *Methods and Procedures for Developing Local Curriculum and School Curriculum According to the Primary and Secondary Education Curriculum B.E. 2551 (2008 Revision) and*

- the Basic Education Curriculum B.E. 2544 (2001). Maha Sarakham: Apichat Printing.
- Nitaya Ritthiyothi. (1977). *Making and Using Exercises to Enhance Skills*. Bangkok: Secondary Educational Service Area Office.
- Pakpaga Srisawang. (2015). *The Effect of Using the 5E Learning Cycle in Mathematics on Sets for Grade 10 Students*. *Journal of Education, Mahasarakham University*, 9(Special Issue), 419-436.
- Pechen Kijrakar and Somnuk Phattiyathani. (2002). Analysis of the Efficiency of Educational Technology Media (E1/E2). *Journal of Educational Measurement*, 8(2), 30-32.
- Pechen Kijrakar. (2001). *Effectiveness Index (E.I.)*. Maha Sarakham: Mahasarakham University.
- Royal Institute. (2003). *Royal Institute Dictionary, B.E. 2542 (1999)*. Bangkok: Akson Charoen Tat Printing.
- Schmidt, H. G. (1993). The Rational Behind Problem Based Learning. *Medical Education*, 17, 11-16.
<https://doi.org/10.1111/j.1365-2923.1983.tb01086.x>
- Siriporn Tipkong. (2002). *Curriculum and Mathematics Teaching*. Bangkok: Academic Quality Development.
- Sriprapha Palsut. (2011). *Creating Exercises*. Bangkok: Thai Wattana Panich Printing.
- Sucha Jan-em. (2004). *Adolescent Psychology*. Faculty of Social Sciences, Kasetsart University.
- Suchon Sinthapanan. (2008). *Develop Thinking Skills, Conquer the Exam*. Bangkok: Liang Chiang Printing.
- Suparat Phansopha. (2022). *Learning Outcomes in Mathematics Learning Area on Time for Grade 4 Students Using Cooperative Learning Team Pair Solo*. Ubon Ratchathani: Rajabhat Ubon Ratchathani University.
- Surang Jarernsuk. (1998). *Learner-Centered Teaching Approach for Mathematics at Secondary Education Level*. Bangkok.
- Susanto, Desrani, A., Ritonga, A. W., Ramli, Lubis, M., & Nurdin. (2023). Learning by doing: A teaching paradigm for active learning in Islamic high school. *Journal of Education and E-Learning Research*, 10(4), 793-799. <https://doi.org/10.20448/jeelr.v10i4.5224>
- Suwit Moolkam and Arthai Moolkam. (2002). *19 Learning Management Methods for Knowledge and Skill*.
- Suwit Moolkam and colleagues. (2008). *Writing Learning Plans Emphasizing Thinking* (3rd ed.). Bangkok: Phapphim Printing.
- Thawal Marsjarat, & Nitchanan Prasong. (2003). *Educational Innovation: Set for Writing Integrated Learning Plans*. Bangkok: Tharnaksorn.
- Thisna Khammanee. (2013). *Teaching Models: Diverse Alternatives* (5th ed.). Bangkok: Active Print Co., Ltd.
- Wallapa Aree-ratan. (2009). *Mathematics Teaching*. Faculty of Education, Khon Kaen University. Office of the National Education Commission. (2002). *National Education Plan (B.E. 2545-2559)*. Bangkok: Office of the National Education Commission.
- Wanakphon Chomchuenjai. (2022). *Active Learning on Ratios, Proportions, and Percentages for Grade 7 Students*. Pathum Thani: Sripatum University.
- Wattanaporn Rangsubthuk. (1999). *Learner-Centered Instructional Design Plan*. Bangkok.
- Weerayuth Duangyai. (2023). *Mathematics Learning Management to Develop Analytical and Problem-Solving Skills Using Active Learning for Grade 8 Students*: Rajabhat Phranakhon University.
- Wimonrat Suntornroj. (2008). *Innovations for Learning*. Department of Curriculum and Instruction, Faculty of Education, Mahasarakham University. Maha Sarakham.