

Problem-Solving Ability Of Class IV Students In Mathematics Of Cuttack District

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Abstract

The study was conducted to explore the Problem Solving Ability of Class IV Students in Mathematics. Case study research design was adopted for this study. The study was conducted at Railway Settlement Primary School, Cuttack. 27 Students of Class IV grade were taken as the Subject of this Study. A Mathematical Problem Solving Ability (MPSA) Test was developed by the Researcher to know about the level of Problem Solving Ability among the Students. The Tool consists of 20 questions and the test duration was 90 minutes. For every right response, one mark was given and for every wrong response zero mark was assigned. The collected data were analyzed by using Polya's four-stage reference, i.e., understanding the problem, planning problem-solving, implementing problem-solving, and re-examining (Polya, 1973). The Major findings of the study was that Students with high Problem-Solving Abilities understood maximum problems, as well as followed correctly planned procedures to solve them, but they committed some procedural errors for which they weren't able to reach the final answer. 85.18% of the students understood the problem. 74.07% of the students planned problem-solving. Only 55.56% of the students were able to perform the plan, and only 7.40% of students were able to confirm the obtained answers.

Keywords : Mathematics, Problem, problem Solving ability, IVth Grade Students

INTRODUCTION:

Education is the manifestation of perfection that already exists within Man. (Swami Vivekananda). It is the foundation of early civilizations and the guiding light for humanity. It is more than just Literacy; it is about developing innovative thinking, self-sufficiency and knowledge acquisition from an early age. Critical thinking, reasoning, comprehension and the exploration of latent knowledge. By nurturing individual development, education equips individuals to adapt to their surroundings and contribute positively to society and the world. It plays a vital role in raising a child's awareness of their rights, cultural heritage, and linguistic environment, and empowers them to use natural resources for their well-being and personal growth. Education is an essential human activity that has existed since the birth of the human race and will continue as long as humans exist. It ensures the survival of the human race maintains intellectual and cultural traditions and helps in developing an enlightened civilization that history has witnessed through the ages (Nandra, 2007). Article 45 of the Constitution states, the state shall ensure universal, free, and compulsory education for all children up to the age of 14 years. Today, the pursuit of "Education for All" stands as the central goal of our educational framework.

RATIONALE OF THE STUDY:

Developing problem solving skills is crucial to Mathematical learning and it is considered the core of this subject. These skills are essential for students not only to learn the subject but also to develop their thinking abilities that have a practical impact on their daily lives. The process of solving mathematical problems can be applied to general problem-solving. Mathematics learning is of paramount importance as it has a significant impact on the quality of education that students receive. However, many students face difficulties in learning the subject particularly in problem- solving.

It is therefore a critical mission for teachers to develop problem-solving abilities among students so that they can acquire the necessary skills. The National Education policy (NEP) 2020 has also emphasizes that the problem-solving abilities can help for developing higher order cognitive capacities among students.

During different stages of schooling, problem-solving can be taught progressively, which is beneficial for both teachers and students. Education is a process of man-making, and in this process, students have to face various obstacles and overcome hindrances in a way that helps them transfer their learning to solve future problems. Successful problem-solving abilities lead to the acquisition of new knowledge, analysis and solving new problems, and understanding scientific facts and principles.

The main aim of the present study is to explore the problem-solving abilities of elementary school students. This study can help teachers improve the teaching-learning process of Mathematics by tailoring their teaching methods to students' levels. Besides, it can inform curriculum developers by identifying the areas where students struggle or excel in problem-solving. These insights can guide the development of targeted interventions to enhance problem-solving skills. This study is significant as it highlights the need to investigate the problem-solving abilities of particularly class IV students in mathematics.

Amalina & Vidakovich (2023) conducted a study on “Development and differences in mathematical problem-solving skills: A cross-sectional study of differences in demographic backgrounds.” The study found that students in classes VII and VIII developed problem-solving skills. Urban students outperformed their rural counterparts, and girls outperformed boys. **Gholami (2023)** studied “Performance of Malaysian Foundation Level Students in Mathematical Problem Solving as well as Gender Comparison.” Most students were unable to solve the problems, but females performed better than males. **Lalduhawma (2023)** conducted “A Study on Problem-Solving Ability of Class XI Students in Aizawl City in Relation to their Stream of Study.” It was discovered that students in both the science and commerce streams have low problem-solving abilities, and there is no significant difference between their skills. **Zhuzhu & Chunxia (2022)** studied “Middle school students' Mathematical Problem-solving Ability and the Influencing Factors in Mainland China.” According to a recent study, 96% of students demonstrated basic problem-solving skills. Additionally, students from urban areas had higher performance compared to those from rural backgrounds. Furthermore, children without siblings showed better results than their peers with siblings. **Wulansari and Jupri (2022)** conducted a study on “Students' Mathematical Problem-Solving Ability: Mathematics Teachers' Perception in Sumatra.” It was found that although students understood the problem, they struggled with planning and executing a solution. Additionally, differences were observed in students' mathematical problem-solving

abilities between online and offline learning. **Vishwanatham (2021)** conducted a study on “Problem-Solving Ability in Mathematics among Secondary School Students with Respect to Parents’ Educational Qualification.” The result reveals a significant difference in problem-solving ability in mathematics among secondary school children to their parents’ educational qualifications. **Syaiful, et al. (2020)** conducted a study on “Identifying of problem-solving abilities in Mathematics among Junior High School students.” 59 students understood the problem, 53 students who were able to plan how to solve the problem, 51 students who solved the problem as per the plan, and 55 students who answered the questions correctly. **Muhafidin, et al. (2020)** conducted a study on “Mathematical problem-solving in students with a disability based on prior mathematics ability.” The findings revealed that one student possessed problem-solving skills in the good category, three students demonstrated sufficient skills, and one student exhibited low skills. However, it is important to note that having good prior mathematics abilities does not necessarily imply good problem-solving skills. **Jakhar (2019)** conducted a study on “Gender as a Predictor of Difference in the Problem-solving Ability of the Students.” The study revealed no significant difference in the students' abilities based on gender. **Ramula and Mugale (2018)** conducted a study on “Problem-Solving Ability in Mathematics of the IX Standard Students in Adilabad District of Telangana.” The study found that the problem-solving ability of Class IX students was average, and there was no significant difference based on gender, locality, or school status. **Kanmani and Nagarathinam (2017)** conducted a study on “Problem-Solving Ability and Academic Achievement of Higher Secondary Students.” The findings discovered that the majority of students possessed an average level of problem-solving ability. Furthermore, there is a positive correlation between problem-solving ability and achievement in mathematics. Interestingly, the gender of the student, as well as the educational qualifications of their parents, stream of education, and type of school, did not play a significant role in determining the problem-solving abilities of the students. **Gupta, et al. (2015)** conducted a study on “The Effect of Problem Solving Ability on Academic Achievement of High School Students.” The study's findings indicate that problem-solving ability has a noteworthy impact on the academic achievement of high school students. Additionally, the study reveals that female students outperformed male students. However, the study did not find any interaction effect between problem-solving ability and gender on the academic achievement of high school students. **Tambychik & Meerah (2010)** studied “Students’ Difficulties in Mathematics Problem-Solving: What do they Say?” According to the research, it was found that the students were deficient in various mathematical skills such as interpreting the information to locate the answers or sketching diagrams and shapes. They faced difficulties in comprehending the problem statement itself and converting the information into numbers and shapes. This deficiency in mathematical skills and cognitive abilities hinders their problem-solving skills in mathematics. Therefore the researcher clearly sees that there is a need to conduct a study to know the problem-solving ability of class IV students in mathematics of Cuttack District.

STATEMENT OF THE PROBLEM:

The present study is entitled as “**Problem Solving Ability of Class IV students in Mathematics of Cuttack Distirct**”.

OBJECTIVE OF THE STUDY:

1. To identify the level of problem-solving ability in mathematics of elementary level students.

RESEARCH QUESTIONS:

1. What is the level of problem-solving ability in mathematics among elementary-level students?

OPERATIONAL DEFINITION OF KEY TERMS:

Problem-Solving Ability - The process of cognitive thinking, reasoning, and judgment is referred to as problem-solving ability, which is used to solve problems. It involves controlling and modulating fundamental skills to achieve a higher-order thinking process. Finding the solution requires identifying the goal of the problem and determining the rules that can be applied. In some cases, it may be necessary to use abstract thinking and creativity to arrive at a successful solution.

Mathematics - The field of mathematics is a scientific discipline that encompasses four basic mathematical operations: addition, subtraction, multiplication, and division. Mathematics education is especially advantageous for students during their secondary school years, as it can contribute to the growth of their imaginative faculties and self-assurance while also promoting effective practices for problem-solving.

METHODOLOGY OF THE STUDY:

Design of the Study

Case study research design was adopted for the present research study. 27 students of Class IVth grade of Railway Settlement Primary school are selected as sample of the present study. A Mathematical Problem Solving Ability (MPSA) Test was developed by the Researcher to know about the level of Problem Solving Ability among the Students. The Tool consists of 20 questions and the test duration was 90 minutes. For every right response, one mark was given and for every wrong response zero mark was assigned. The collected data were analyzed by using Polya's four-stage reference, i.e., understanding the problem, planning problem-solving, implementing problem-solving, and re-examining (Polya, 1973).

PROCEDURE OF DATA ANALYSIS:

The analysis and interpretation of the data are carried out by the data collected from the students of Railway Settlement Primary School in the Cuttack district. Individual student responses to the MPSA Test were analyzed using Polya's four-stage reference, i.e., understanding the problem, planning problem-solving, implementing problem-solving, and re-examining (Polya, 1973). The first and second procedure is observed through the student's answer, whereas the process phase can be explained as the process of solving the problem. And rechecking ensures the correctness of the solution.

Objective: To identify the level of problem-solving ability in mathematics of elementary level students.

Research question: What is the level of problem-solving ability in mathematics among elementary-level students?

Student-1: Student-1 could understand only 80% of the total questions, but he could correctly plan 75% of the total questions. However, he was only able to follow the correct procedure for only 70% of them and solve them correctly. He wasn't able to understand 25% of the questions, those questions were left un-attempted. However, his accuracy is 93%, as he got almost all attempted questions correct.

Student-2: Student-2 was able to understand only 65% of the total questions, and correctly plan 70% of them. However, he was only able to follow the correct procedure for only 60% of them and solve them correctly. He wasn't able to understand 35% of the questions, those questions were either left un-attempted i.e., 20% or they were incorrect, i.e., 15% of the total questions. This student had an accuracy of 75%.

Student-3: Student-3 could understand only 45% of the questions and correctly plan them. Whereas, 10% of them were incorrect and 45% of the questions were left un-attempted. He wasn't even able to understand 55% of the questions itself. Yet, he got 81% of the attempted questions right.

Student-4: Student-4 could only understand 10% of the total questions, as well as correctly plan them, yet he wasn't able to solve any of the questions correctly. His score was 0%. Out of the 25% attempted questions, 60% of them were incorrect, and 40% of them were only understood and planned correctly, without concluding them.

Student-5: Student-5 also could only understand 10% of the total questions, as well as correctly plan them, yet he wasn't able to solve any of the questions correctly. His score was 0%. Out of the 25% attempted questions, 60% of them were incorrect, and 40% of them were only understood and planned correctly, without concluding them.

Student-6: Student-6 wasn't even able to understand any of the questions. His score was 0%. He attempted only 10% of the total questions, and they were all incorrect. 90% of the questions were left un-attempted.

Student-7: Student-7 could understand only 35% of the questions and correctly plan and solve them. Whereas, 40% of the total questions were incorrect and 25% of the questions were left un-attempted. He wasn't able to understand 65% of the questions itself. Yet, he got 46.7% of the attempted questions right.

Student-8: Student-8 also could only understand 25% of the total questions, as well as correctly plan them, yet he was only able to solve 5% questions correctly. His score was 5% only. 70% of the total questions were left un-attempted. But, out of the 30% of the attempted questions, 16% of them were incorrect, and another 16% of them were only understood, planned, and solved correctly. Whereas 66.7% of the attempted questions were correctly understood and planned but were left without concluding them. This makes his accuracy at around 16% only.

Student-9: Student-9 could understand, plan, and solve only 25% of the total questions, whereas, 15% of the total questions were incorrect. He wasn't able to understand 65% of the questions, those questions were left un-attempted. However, his accuracy is 62.5%, as he got them correct from the attempted questions.

Student-10: Student-10 could understand, plan, and solve only 15% of the total questions, whereas, 30% of the total questions were incorrect. He wasn't even able to understand 55% of the questions, those questions were left un-attempted. However, his accuracy is at only 33.33%, as he got them correct out of the attempted questions.

Student-11: Student-11 could understand only 60% of the total questions, and correctly plan the answers. However, he was only able to follow the correct procedure for only

55% of them and solve them correctly. But, 5% of them weren't concluded. He wasn't able to understand 40% of the total questions, those questions were left un-attempted. However, his accuracy is 91.67%, as he got almost all attempted questions correct.

Student-12: Student-12 could understand only 20% of the questions and correctly plan and solve them. Whereas, 10% of the total questions were incorrect and 70% of the questions were left un-attempted. He wasn't able to understand 80% of the questions itself. Yet, he got 66.7% of the attempted questions right.

Student-13: Student-13 could understand only 25% of the questions and correctly plan and solve them. Whereas, 10% of the total questions were incorrect and 65% of the questions were left un-attempted. He wasn't able to understand 75% of the questions itself. Yet, he got 71.4% of the attempted questions right.

Student-14: Student-14 could only understand, plan, and solve 5% of the total question. Other 95% of the questions were not understood by him. He attempted 25% of the total questions, out of which 80% were not understood, and were also planned incorrectly, after which it was left without any conclusion. He has an accuracy of only 20% as he got only these questions correct out of all the attempted questions.

Student-15: Student-15 could understand only 10% of the questions and correctly plan and solve them. Whereas, 20% of the total questions were incorrect and 70% of the questions were left un-attempted. He wasn't able to understand 90% of the questions itself. Yet, he got 33.4% of the attempted questions right.

Student-16: Student-16 could understand only 15% of the questions and correctly plan and solve them. Whereas, 5% of the total questions were incorrect and 80% of the questions were left un-attempted. He wasn't able to understand 85% of the total questions. Yet, his accuracy is at 25% of the attempted questions.

Student-17: Student-17 was able to understand only 30% of the total questions, and correctly planned them. However, he was only able to follow the correct procedure for only 25% of them and solve them correctly. He wasn't able to understand 70% of the questions, those questions were either left un-attempted i.e., 30% or they were incorrect, i.e., 40% of the total questions. This student had an accuracy of only 38.4%.

Student-18: Student-18 could understand, plan, and solve only 25% of the total questions, whereas, 5% of the total questions were incorrect. He wasn't able to understand 75% of the questions. Out of those questions, 70% were left un-attempted. However, his accuracy is 83.3%, as he got them correct from the attempted questions.

Student-19: Student-19 could understand only 15% of the questions and correctly plan and solve them. Whereas, 60% of the total questions were incorrect and 25% of the questions were left un-attempted. He wasn't able to understand 85% of the questions itself. Yet, he got 20% of the attempted questions right.

Student-20: Student-20 could understand only 15% of the questions and correctly plan and solve them. Whereas, 15% of the total questions were incorrect and 70% of the questions were left un-attempted. He wasn't able to understand 85% of the questions itself. Yet, he got 50% of the attempted questions right.

Student-21: Student-21 also could only understand 10% of the total questions, as well as correctly plan them, yet he wasn't able to solve any of the questions correctly. His score was 0%. Out of the 15% attempted questions, 33% of them were incorrect, and 66% of them were only understood and planned correctly, without concluding them.

Student-22: Student-22 could understand only 80% of the total questions, correctly plan, and solve the questions. Whereas 10% of the total questions were incorrect. He wasn't able to understand 20% of the questions. 10% of the total questions were left un-attempted. However, his accuracy is 88%, as he got almost all attempted questions correct.

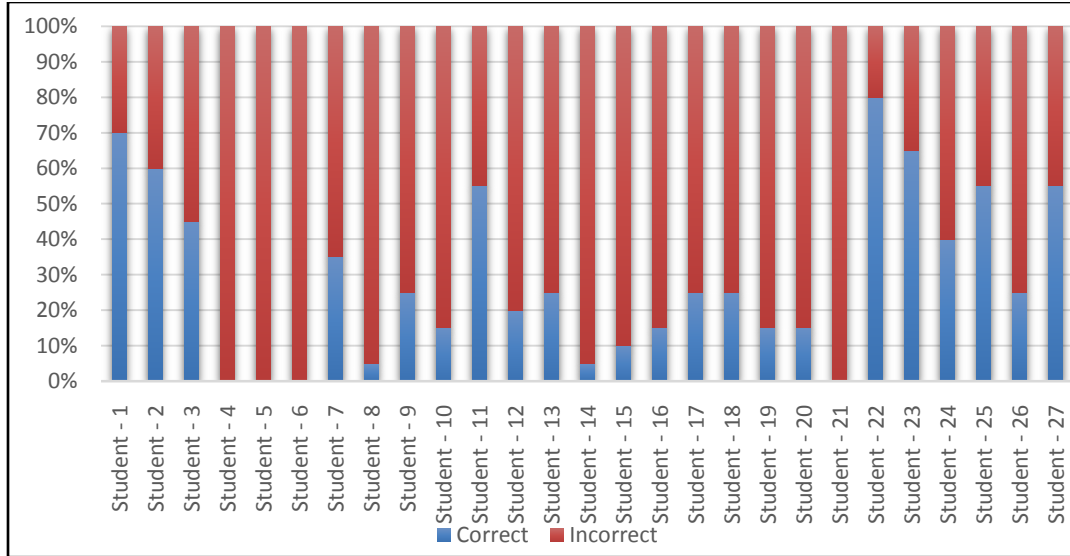
Student-23: Student-23 could understand only 65% of the total questions, correctly plan, and solve the questions. Whereas 20% of the total questions were incorrect. He wasn't able to understand 35% of the questions. 15% of the total questions were left un-attempted. However, his accuracy is at 76%.

Student-24: Student-24 could understand only 40% of the total questions, correctly plan, and solve the questions. Whereas, 15% of the total questions were incorrect. He wasn't able to understand 60% of the questions. 45% of the total questions were left un-attempted. However, his accuracy is at 72%.

Student-25: Student-25 could understand only 55% of the total questions, correctly plan, and solve the questions. Whereas 5% of the total questions were incorrect. He wasn't able to understand 45% of the questions. 40% of the total questions were left un-attempted. However, his accuracy is 91.6%, as he got almost all attempted questions correct.

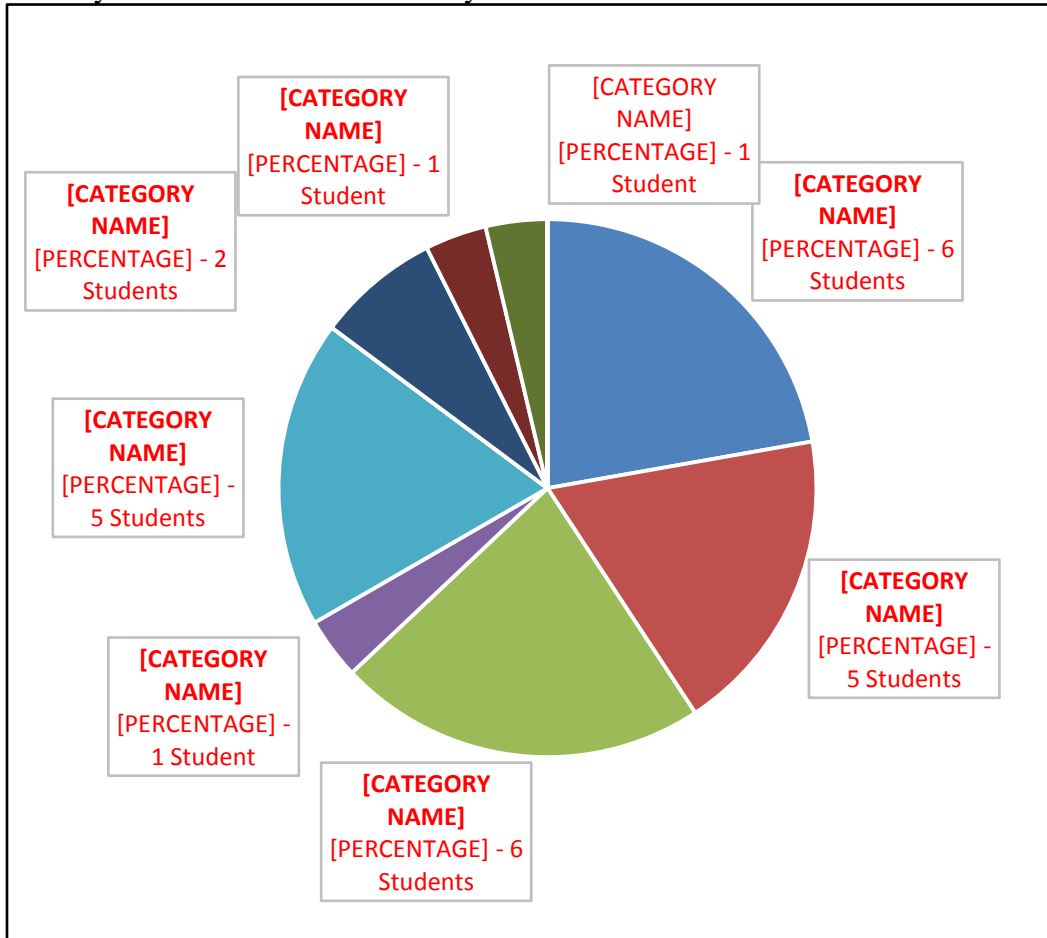
Student-26: Student-26 could understand only 25% of the total questions, correctly plan, and solve the questions. Whereas, 20% of the total questions were incorrect. He wasn't able to understand 75% of the questions. 55% of the total questions were left un-attempted. However, his accuracy was only 55%.

Student-27: Student-27 could understand only 55% of the total questions, correctly plan, and solve the questions. Whereas 15% of the total questions were incorrect. He wasn't able to understand 45% of the questions. 30% of the total questions were left un-attempted. However, his accuracy is at 78.5%.



Graph 1: Data of each student showing no. of correct and incorrect answers to the given 20 questions.

The above analysis shows the different levels of problem-solving abilities of students of Railway Settlement Primary School in the Cuttack district.



Graph 2: Chart showing the percentage scored by 27 students in the MPSA Test

From the above chart, we can interpret that 6 students scored between 0%-10percent. 5 students scored between 10%-20%, 6 students scored between 20%-30%. Only 1 student scored between 30%-40%, 5 students between 40%-50%, and none of the students scored between 50% to 60%

2 students scored between 60%-70%, and only 1 student scored between 70%-80% and 80%-90%. None of them were able to score above 90%.

Table 1: The Problem-Solving Phases cleared by the students (according to G.Polya)

Phase	No. of Students
Understanding the problem	23
Planning the problem-solving	20
Implementing the problem-solving	15
Re-examining	2

85.18% of the students understood the problem. 74.07% of the students planned problem-solving, by writing the correct pieces of information and drawing the correct shapes that are provided in the question before solving the problem. 55.56% of the students were able to perform the plan and follow the correct procedures to solve the problem. They showed their grasp of the basics of the subject. Only 7.40% of students were able to confirm the answers and correctly write the final answers to the questions with the conclusion.

Table 2: Level of Problem-Solving Ability of the Students

Scores	Level	No. of Students
0%-30%	Low Problem-Solving Ability	17
30%-70%	Average Problem-Solving Ability	8
70%-100%	High Problem-Solving Ability	2

Maximum students have low problem-solving ability, as the students face a lot of difficulties in understanding and planning the correct solutions to the problems. They were unable to figure out the information provided in the questions. And there are only 2 students with high problem-solving ability, who performed exceptionally well by not only drawing out the correct information but by drawing the figures and carrying out the correct procedure as well.

RESULTS & DISCUSSION:

- The majority, i.e., 62.96% of the total students scored less than 30% in the MPSA Test, showing low problem-solving ability.
- Only 7.40% of the total students had high problem-solving ability, scoring above 70% on the MPSA test.

- Students with high Problem-Solving Abilities understood maximum problems, as well as followed correctly planned procedures to solve them, but they committed some procedural errors for which they weren't able to reach the final answer.
- Students with average problem-solving abilities understood the problems but had major issues in planning solutions. They weren't able to extract the information from the questions. Some of them made mistakes in writing the correct digits, and mathematical symbols making it impossible for them to reach the right answer.
- Students with low problem-solving abilities had issues with even understanding the problem. Few students weren't able to even read properly.
- 85.18% of the students understood the problem. 74.07% of the students planned problem-solving. Only 55.56% of the students were able to perform the plan, and only 7.40% of students were able to confirm the obtained answers.

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