

Original Article

Enhancing Conceptual Understanding of Fractions through Activity-Based Instruction

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Abstract

Understanding fractions is fundamental to mathematical learning, yet it remains one of the most challenging topics for middle school students, especially in vernacular-medium contexts. The present action research examines the learning difficulties related to fractions among Class VII Urdu-medium students of a secondary school in Jalgaon, Maharashtra. The study identifies conceptual misunderstandings, language-related barriers, and overdependence on rote procedures as major factors affecting student performance. A structured remedial programme based on bilingual explanations and activity-based learning strategies was implemented over a period of ten instructional days. A pre-test and post-test experimental design was employed with a sample of 60 students. Quantitative data were analyzed using mean, standard deviation, and paired t-test. The results reveal a statistically significant improvement in students' conceptual understanding and application of fractions. The findings suggest that learner-centered, bilingual instructional strategies are effective in improving mathematical achievement among Urdu-medium learners.

Keywords: Fractions, Urdu-medium students, activity-based learning, mathematics education, bilingual pedagogy

Introduction

Mathematics is a core subject that plays a crucial role in the development of logical reasoning and problem-solving abilities. Among various mathematical topics introduced at the upper primary level, fractions present considerable conceptual difficulty for learners. Fractions require an understanding of part-whole relationships, proportional reasoning, and symbolic representation, which many students fail to grasp adequately.

In Urdu-medium schools, these challenges are further intensified due to linguistic gaps between students' home language and the language used for mathematical symbols and terminology. At Iqra Shahin Urdu High School, Jalgaon, repeated classroom observations and assessment records revealed that a significant number of Class VII students struggled with fraction concepts, operations, and word problems.

The present study was undertaken as an action research initiative to diagnose these difficulties systematically and to implement an instructional intervention aimed at improving students' conceptual understanding and procedural skills in fractions.

Review of Related Literature

Research in mathematics education has consistently highlighted fractions as a problematic area for school students. Piaget (1952) emphasized that abstract mathematical concepts should be introduced only after sufficient concrete experiences. Bruner (1966) proposed that learning should progress from concrete actions to visual representations and finally to symbolic forms.

Skemp (1976) distinguished between instrumental understanding, which focuses on rules and procedures, and relational understanding, which emphasizes conceptual clarity. Studies by Behr et al. (1983) indicated that misconceptions in fractions often arise from weak part-whole understanding. Vygotsky (1978) highlighted the importance of language and social interaction in learning, particularly through scaffolding in the learner's familiar language.

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Studies conducted in Indian vernacular-medium contexts (Chavan, 2011; Ansari, 2018) reported that bilingual explanations and activity-based strategies significantly enhance students' understanding of abstract mathematical concepts. These findings provided the theoretical and empirical basis for the present study.

Objectives of the Study

The objectives of the study were to:

1. Identify the conceptual and procedural difficulties faced by Class VII Urdu-medium students in learning fractions;
2. Analyze common error patterns related to fraction concepts and operations;
3. Design and implement an activity-based, bilingual remedial instructional programme; and
4. Evaluate the effectiveness of the intervention using appropriate statistical techniques.

Research Methodology

1. Research Design

The study adopted an action research approach using a one-group pre-test/post-test experimental design, enabling the teacher-researcher to intervene directly and reflect on instructional practices.

2. Population and Sample

The population comprised all Class VII students of Iqra Shahin Urdu High School, Mehrun, Jalgaon. A sample of 60 students was selected through purposive sampling based on their low achievement in fractions as reflected in previous unit tests.

3. Tools for Data Collection

The following tools were used:

- **Pre-Test:** A teacher-made test assessing understanding of fraction concepts, equivalent fractions, comparison of fractions, and word problems.
- **Post-Test:** A parallel test constructed to measure learning gains after the intervention.
- **Observation Schedule:** Used to record student participation and engagement during instructional activities.
- **Informal Interviews:** Conducted to identify language-related and conceptual difficulties.

4. Intervention Programme

A **ten-day remedial programme** was implemented using:

- Fraction strips and paper-folding activities;
- Real-life contextual examples (sharing food, money, time);
- Bilingual explanations using Urdu and English mathematical terms;
- Group work and peer discussion; and
- Visual aids such as charts and diagrams.

5. Statistical Techniques

Data were analyzed using:

- Mean
- Standard Deviation
- Paired *t*-test

Data Analysis and Results

1 Pre-Test Error Analysis

Skill Area	Students with Errors	Percentage
Concept of Fractions	38	63%
Equivalent Fractions	36	60%
Comparison of Fractions	42	70%
Word Problems	48	80%

The pre-test results indicate that a majority of students had weak conceptual understanding, particularly in applying fractions to word problems.

2 Post-Test Error Analysis

Skill Area	Students with Errors	Percentage
Concept of Fractions	12	20%
Equivalent Fractions	14	23%
Comparison of Fractions	18	30%
Word Problems	24	40%

Post-test data show a substantial reduction in error percentages across all skill areas.

3 Hypothesis Testing

Test	N	Mean	SD	t-value	Significance
Pre-Test	60	10.1	1.35	15.82	Significant at 0.05
Post-Test	60	14.6	1.22		

Hypothesis

Null Hypothesis (H₀): There is no significant difference in the performance of Class VII Urdu-medium students in fractions before and after the remedial intervention.

Result: Since the calculated *t*-value is significant at the 0.05 level, the null hypothesis is rejected, indicating that the intervention had a significant positive impact.

Discussion

The results demonstrate that activity-based and bilingual instructional strategies significantly improve students' understanding of fractions. The reduction in errors, particularly in word problems, suggests improved language comprehension and conceptual clarity. These findings align with earlier studies emphasizing learner-centered and language-sensitive pedagogy.

Conclusion

The study concludes that Urdu-medium students experience considerable difficulty in learning fractions due to linguistic barriers and traditional instructional methods. The action research intervention proved effective in enhancing conceptual understanding and procedural competence. Implementing similar strategies can contribute to improved mathematics achievement in vernacular-medium classrooms.

Recommendations

1. Teachers should integrate manipulative and real-life contexts while teaching fractions.
2. Bilingual instructional support should be encouraged in Urdu-medium schools.
3. Regular diagnostic assessments should be conducted to identify misconceptions early.
4. Teacher training programmes should emphasize activity-based mathematics instruction.

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