A study on Algebraic Expressions : Activity-Oriented Learning

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Abstract - In this paper, three activities, including illustrations on 'Acquaintance with terms and types of algebraic expressions, have been developed and presented sequentially for the target group, i.e. the learners, considering their ages, grades and ability levels. The collection of textbooks, analysis of textbooks/textbook scanning, developing the activity, sequencing of steps of the activity and experts' opinions are the materials and methods which have been adopted for this study. These activities, including their illustrations, are more meaningful and logical in comparison to the activities presented in the textbooks of mathematics by the National Council of Educational Research and Training (N.C.E.R.T.) All these activities have also been developed by the researcher with a new look. All these activities will definitely help the learners to get the relish for learning the acquaintance with terms and types of algebraic expressions.

Keywords - Terms, Factors of a term, Co-efficient of a term, Types of algebraic expressions, Upper primary level, Activity-oriented learning, Peer group, Developing the activity, Textbook scanning.

1. Introduction

'Algebraic expressions' is, in fact, a combination of variables and constants. So, it represents a number. Now, the matter is how the algebraic expressions are formed and combined. Special care should be needed to learn it because this is one of the basic concepts of algebra- an important branch of mathematics. In our country, considering the importance of the concept, it has already been introduced at the beginning of the upper primary level, i.e. class-VI, i.e. at 11-12 years of age. But it is seen that a large number of learners have no proper idea about terms and types of algebraic expressions. So, it should be learnt in a meaningful and logical way. Otherwise, they will be deprived of having the taste of logical beauty and its abstraction. As a result, a phobia towards mathematics as well as algebra is being also started among the learners at this level. They cannot achieve the learning competencies properly in algebra. The root cause of it is that it is not inculcated in the proper way among them. An improper teaching-learning approach is one of the important reasons behind this. In our educational environment, there are several types of learners according to grade levels, age levels, ability levels etc. All these are to be considered at the time of the teaching-learning process. So, the proper activities are needed that will help the learners to develop their natural process of reasoning on the basic concepts of

algebra. So, the 'activity-based learning approach' in pair group mode helps to concretize the concepts. For this approach, several types of activities are needed [21-23,30,31]. The researcher has already developed some activities on different major concepts of mathematics [24-29]. He has emphasized developing the activities on 'acquaintance with terms and types of algebraic expressions' in this paper. Although the activities on 'acquaintance with terms and types of algebraic expressions' have been introduced in the prescribed textbooks of mathematics of the National Council of Educational Research and Training (N.C.E.R.T.) both. But they are not fulfilled the target group's needs.

Therefore, in this paper, three activities, including their illustrations on 'acquaintance with terms and types of algebraic expressions' have been developed and presented sequentially, which will help the learners to get the relish for learning the same.

2. Objective of the Study

The aim of this study is to develop various learning activities for acquaintance with terms and types of algebraic expressions.

3. Materials and Methods

Materials and methods have been discussed below:

3.1. Collection of TextBooks

The prescribed textbooks of mathematics from class-I to the class-X standard of West Bengal Board of Primary Education N.C.E.R.T. and other available books from the market were collected at first [1-20, 32].

3.2. Analysis of Text Books/Text Book Scanning

The books were analyzed to identify the activities of the 'Acquaintance with terms and types of algebraic expressions' in
algebra.

3.3. Developing the Activities

The activities for 'Acquaintance with terms and types of algebraic expressions' were developed considering the psychological order of learners and the learners' ability level.

3.4. Sequencing of Activities

The developed activities were sequenced, keeping in view the logical order of the subject matter and the psychological order of learners. The gaps in activities, if any, detected by the researcher were filled in by him at the initial stage.

3.5. Experts' Opinions

Experts' opinions were taken on the developed activities.

Finally, the sequential form of the activities 'Acquaintance with terms and types of algebraic expressions' incorporating the experts' opinions was developed.

4. Salient Points of the Study

A total of three activities for 'Acquaintance with terms and types of algebraic expressions' have sequentially been

developed by the researcher.

Learners will acquire knowledge about the above-mentioned ideas through their active participation in real-life situations,

natural facts and phenomena. Here, the 'teacher' will play the role of a 'facilitator'.

Here, these activities, including illustrations for 'Acquaintance with terms and types of algebraic expressions, have been presented below in the sequential form. These have been done through 3 sub-concepts:

- Acquaintance with terms of an algebraic expression, factors of a term, and co-efficient of a term.
- Acquaintance with like and unlike terms of algebraic expressions.
- Acquaintance with types of algebraic expressions.

4.1. Acquaintance with Terms of an Algebraic Expression, Factors of a Term, and Co-efficient of a Term

One activity and its illustration of the sub-concept: 1. Acquaintance with terms of an algebraic expression, factors of a term, and co-efficient of a term have been developed and presented sequentially below.

Activity-1: Acquaintance with terms of an algebraic expression, factors of a term, and co-efficient of a term. Requirements: A chart of algebraic expressions, exercise book, pen/pencil.

Mode: Pair group.

Strategy: Learning through activities.

Objective of the development: Cognitive development.

Stage-I: The facilitator will do the following activities involving the learners.

1. After showing an algebraic expression $2xy+7$, then the facilitator will ask the learners what it is.
2. After receiving the response of the learners, s/he will provide ideas about terms, and factors of a term, drawing a tree diagram of factors and terms of the algebraic expression and co-efficient of a term.

Stage II: The learners will do the following activities with the help of a

facilitator if needed. Each paired group:

1. Writes the algebraic expression 3–5yz.

2. Writes the terms of the expression 3–5yz.

3. Factorizes numerical and algebraic parts of the term–5yz.

4. Writes the factors of the algebraic part in such a way that the factors cannot be further factorized.

5. Draws a tree diagram of 3–5yz mentioning terms and factors. Here, 1 will not be taken as a separate factor.

6. Writes the coefficients of yz, y, z, 5yz, 5y, 5z of the term–5yz.

The work is illustrated below:
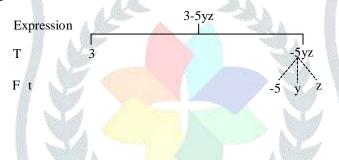
The algebraic expression =3–5yz.

The terms of the expression 3–5yz are 3

and –5yz. The factors of 3 are 1, 3.

The factors of –5yz are 1, –1, 5, –5, 5y, –5y, 5z, –5z, yz, –yz, y, z, –y, –z, 5yz, –5yz. The factors of –5yz are –5, y, z, which are cannot be further factorized.

The tree diagram of 3–5yz is given below.

The co-efficient of yz, y, z, 5yz, 5y, 5z of the term–5yz are–5,–5z,–5y,–1,–z,–y respectively.

4.2. Acquaintance with Like and Unlike Terms of Algebraic Expressions

One activity and its illustration of the sub-concept: 2. Acquaintance with like and unlike terms of algebraic expressionshave been developed and presented sequentially below.

Activity-1: Acquaintance with like and unlike terms of algebraic

expressions.Requirements: Exercise book, pen/pencil.
Mode: Pair group.
Strategy: Learning through activities.
Objective of the development: Cognitive development.

Stage-I: The facilitator will do the following activities involving
the learners.The facilitator will ask the following questions.
1. What are the terms of the expression 3ab–5+7ab?
2. Tells the factors of each term, i.e. 3ab,–5, 7ab.
3. What are called terms when terms have the same algebraic factors?
4. What are called terms when terms have different algebraic factors?
5. Explain then the question nos.-3 & 4 in respect of question no.-2.

Stage II: The learners will do the following activities with the help of the

facilitator if needed.Each paired group:

1. Fills the gaps of the following Table-1 identifying the following pairs of terms, which are of like terms and which areof unlike terms stating proper reasons.
   i. 5a, 7b
   ii. –9c, 2c
   iii. 3pq, 7p
   iv. 2xy,–yx
   v. $-mn^2$, $7nm^2$
   vi. $-4p^2q$, p^2q

The solution of (i) has been done in Table-1 for better understanding.

Table 1. Factors, types of algebraic factors, types of terms and remarks of pairs of terms

S. No.	Pair	Factors	Types of algebraic factors	Types of terms (Unlike/like terms)	Remarks
i.	5a 7b	5, a 7, b	Different	Unlike	The variables in terms are different.
ii. –9c	2c	------------------ ------------------	_____	_____	--------------------------------- ---------------------------------
iii.	3pq 7p	------------------ ------------------	_____	_____	--------------------------------- ---------------------------------
iv.	2xy –yx	------------------ ------------------	_____	_____	--------------------------------- ---------------------------------
v. –mn	^{2} $7nm^2$	------------------ ------------------	_____	_____	--------------------------------- ---------------------------------
vi. –4p	^{2}q p^2q	------------------ ------------------	_____	_____	--------------------------------- ---------------------------------

The work is illustrated below:
Each paired group will fill up Table-1, which is presented below as Table-2.

Table 2. Factors, types of algebraic factors, types of terms and remarks of pairs of terms (Filled up)

S. No.	Pair	Factors	Types of algebraic factors	Types of terms (Unlike/like terms)	Remarks
i.	5a 7b	5, a 7, b	Different	Unlike	The variables in terms are different.
ii. –9c	2c	–9, c 2, c	Same	Like	The variables in terms are the same.
iii.	3pq 7p	3, p, q 7, p	Different	Unlike	One variable, in terms, is the same, but the other is not.
iv.	2xy –yx	2, x, y –1, y, x	Same	Like	Remember xy=yx The variables in terms are the same.
v. –mn	$7nm^2$	–1, m, n, n 7, n, m, m	Different	Unlike	The variables in terms are different.
vi. –4p	^2q p^2q	–4, p, p, q p, p, q	Same	Like	The variables in terms are the same.

4.3. Acquaintance with Types of Algebraic Expressions

One activity and its illustration of the sub-concept: 3. Acquaintance with types of algebraic expressions have been developed and presented sequentially below.

Activity-1: Acquaintance with types of algebraic expressions.

Requirements: A table of algebraic expressions and their generic names, no. of terms and particular names, exercise book, pen/pencil.
Mode: Pair group.
Strategy: Learning through activities.
Objective of the development: Cognitive development.

Stage-I: The facilitator will do the following activities involving the learners.

The facilitator will show the following table-3 to the learners to acquaint them with the expression, i.e. monomial, binomial, trinomial etc.

Table 3. Algebraic expressions and their general names, no. of terms and particular names

Algebraic Expression	General name	No. of terms	Particular name
a	Polynomial	1	Monomial
a+b	Polynomial	2	Binomial
a+b+c	Polynomial	3	Trinomial
a+b+c+d	Polynomial	4	Four-term Polynomial
a+b+c+d+e	Polynomial	5	Five-term Polynomial

Then, the learners will be asked about monomials, binomials, trinomials and polynomials.

Stage II: The learners will do the following activities with the help of the

facilitator if needed. Each paired group:

1. Fills in the blanks of the following Table-4.

Table 4. Algebraic expressions and their general names, no. of terms and particular names

Algebraic Expression	General name	No. of terms	Particular name
x^2	------------------------	----------------	---------------------------------------
xy+3	------------------------	----------------	---------------------------------------
x^2+y+z	------------------------	----------------	---------------------------------------
a+m+l+p^2	------------------------	----------------	---------------------------------------
x^2y+y x^2+z^2+z+5	------------------------	----------------	---------------------------------------

The work is illustrated below:

Each paired group will fill up Table-4, which is presented below as Table-5.

Table 5. Algebraic expressions and their general names, no. of terms and particular names (Filled up)

Algebraic Expression	General name	No. of terms	Particular name
x^2	Polynomial	1	Monomial
xy+3	Polynomial	2	Binomial
x^2+y+z	Polynomial	3	Trinomial
a+m+l+p^2	Polynomial	4	Four-term Polynomial
x^2y+y x^2+z^2+z+5	Polynomial	5	Five-term Polynomial

Remarks:

This study may be extended for the algebraic expression having both like and unlike terms after the addition of like terms.

5. Conclusion

This paper contains three activities, including their illustrations for 'Acquaintance with terms and types of algebraic expressions', has been developed and presented sequentially.

These activities, including their illustrations, are developed in a more meaningful and logical way in comparison to the activities presented in the prescribed textbooks of mathematics in N.C.E.R.T.

This study will help the learners to understand terms of algebraic expressions, factors of a term, the co-efficient of a term and types of algebraic expressions through activity-oriented learning.

This study will also help to prepare a proper syllabus, to develop a good textbook and to improve the quality of the teaching-learning process on acquaintance with terms and types of algebraic expressions of algebra.

These types of activities will help the children to enjoy learning mathematics so that their phobia of mathematics will be reduced and stop the dropout of learners who leave from the institution on account of anxiety about mathematics learning.

Special interest towards mathematics can be enhanced, which will be helpful for the entire science education.

As these activities are presented step by step, i.e. in an iterative sequential form. This can be

appropriate in preparing textmaterial through computer-based learning.

Implementation

This study may be implemented in textbooks of mathematics at the school level. It could also be used in the teaching-learning process.

Further Study

All activities on acquaintance with terms and types of algebraic expressions may be applied to the large number of samplesof class-VII.

References

[1] Amar Boi-I, Paschimbanga Prathamik Siksha Parshard, West Bengal, India, December, 2013.

[2] Amar Boi-II, Paschimbanga Prathamik Siksha Parshard, West Bengal, India, December, 2013.

[3] Amar Ganit-III, Paschimbanga Prathamik Siksha Parshard, West Bengal, India, December, 2012.

[4] Amar Ganit-IV, Paschimbanga Prathamik Siksha Parshard, West Bengal, India, December, 2013.

[5] Amar Ganit-V, Paschimbanga Prathamik Siksha Parshard, West Bengal, India, December, 2013.

[6] Ganit Prabha, Class-VI, Paschimbanga Madhya SikshaParshard, West Bengal, India, December, 2013.

[7] Ganit Prabha, Class-VII, Paschimbanga Madhya SikshaParshard, West Bengal, India, December, 2013.

[8] Ganit Prabha, Class-VIII, Paschimbanga Madhya SikshaParshard, West Bengal, India, December, 2013.

[9] Ganit, Class-IX, Paschimbanga Madhya SikshaParshard, West Bengal, India, August, 2011.

[10] Ganit, Class-X, Paschimbanga Madhya SikshaParshard, West Bengal, India, January, 2010.

[11] Math-Magic 1, Textbook in Mathematics for Class-I, National Council of Educational Research and Training, New Delhi, October,2013.

[12] Math-Magic Book 2, Textbook in Mathematics for Class-II, National Council of Educational Research and Training, New Delhi,January, 2013.

[13] Math-Magic Book 3, Textbook in Mathematics for Class-III, National Council of Educational Research and Training, New Delhi,December, 2012.

[14] Math-Magic Book 4, Textbook in Mathematics for Class-IV, National Council of Educational Research and Training, New Delhi,December, 2013.

[15] Math-Magic Book 5, Textbook in Mathematics for Class-V, National Council of Educational Research and Training, New Delhi,January, 2011.

[16] Mathematics, Textbook for Class-VI, National Council of Educational Research and Training, New Delhi, January, 2013.

[17] Mathematics, Textbook for Class-VII, National Council of Educational Research and Training, New Delhi, October, 2013.

[18] Mathematics, Textbook for Class-VIII, National Council of Educational Research and Training, New Delhi, November, 2013.

[19] Mathematics, Textbook for Class-IX, National Council of Educational Research and Training, New Delhi, October, 2013.

[20] Mathematics, Textbook for Class-X, National Council of Educational Research and Training, New Delhi, November, 2012.

[21] National Curriculum Framework (2000), P-57, NCERT, New Delhi, India.

[22] National Curriculum Framework (2005), P-45, NCERT, New Delhi, India.

[23] Position Paper National Focus Group on Teaching Mathematics (2006), P-18, NCERT, New Delhi, India.

[24] Sk. SamsulAlam, Circle: Activity Oriented Learning, APH Publishing Corporation, 4435-36/7, Ansari Road, Darya Ganj, New Delhi110 002, 2017.

[25] Sk. SamsulAlam, "Variable & Constant: Activity Oriented Learning,"*APH Publishing Corporation*, vol. 4435, no. 36/7, Ansari Road,Darya Ganj, New Delhi 110 002, 2018.

[26] Sk. SamsulAlam, Integer: A Learning Process, RENOVA, ISSN 2454-1710, Vol.-4, No.-1, 45-57, 2018.

[27] Sk. SamsulAlam, "Addition of Integers: A Learning Process,"*Indian Journal of Mathematics Teaching*, no. 1 & 2, pp. 4-14, 2018.

[28] Sk. SamsulAlam, "Acquaintance with Integers through Calibration of Beaker: A Learning Process,"*RENOVA*, vol. 5, no. 1, pp. 62-70, 2019.

[29] Sk. SamsulAlam, "Addition of Two Equal And Opposite Integers: A Learning Process,"*Indian Journal of Mathematics Trends and Technology*, vol. 69, no. 3, pp. 50-57, 2023. [CrossRef] [Publisher link]

[30] Suydam, M., and Higgins, J., Activity-based Learning in Elementary School Mathematics: Recommendations from Research. Columbus, OH: ERIC Clearing house on Science, Mathematics and Environmental Education. ERIC Document No. EDl44840, 1977. [Online]. Available: www.eric.ed.gov/ERICWebPortal/recordDetail?accno=ED144840

[31] T. Swarupa Rani, "Teaching of Mathematics Modern Methods,"*APH Publishing Corporation*, 4435-36/7, Ansari Road, Darya Ganj, New Delhi 110 002, p. 134, 2012.

[32] The School Mathematics Project, Facilitator's Guide for Book E, Cambridge at the University Press, pp. 146-147, 1970.