Academic Achievement Gap in Different Mathematical Skills/Abilities of Grade V Students

Chandra Kanta Giri* and Gowramma I.P.**

Abstract

The aim of the study was to find out the academic achievement gap of Grade V students in different mathematical skills/abilities. Academic achievement gap refers to the gap or difference between academic achievement that should be expected from the students according to their grade position and the academic achievement which is found in their performance based on a mathematical test administered in the study. Different mathematical skills/abilities considered for this study were number concept, addition, subtraction, multiplication, division, geometry, measurement, time, calendar, money and pattern. This study was a part of an experimental research and Grade V students of a school (chosen purposively) were the participants of the study. To find academic achievement gap in different mathematical skills/abilities a test on mathematical skills/abilities was administered. It was found that all the participants have academic achievement gap in measurement and calendar; 96 per cent participants in number concept and multiplication; more than 80 per cent in rest of the mathematical skills/abilities. Surprisingly it was seen that more than 70 per cent of the total participants have not reached Grade I level in 5 mathematical skills/abilities out of the 11 skills/abilities that are assessed. Due to this academic achievement gap, students struggled to learn mathematics as they go to higher grades. Hence,

**Research Scholar,* Department of Education, Regional Institute of Education, NCERT, Bhubaneswar (e-mail:gowriip@gmail.com).

***Professor, HOD,* Department of Education, Regional Institute of Education, NCERT, Bhubaneswar (e-mail:gowriip@gmail.com).

there is a need to identify this in the initial stage of school education and bridge the gap as early as possible.

Keywords: *Academic Achievement, Academic Achievement Gap, Mathematical Skill/Ability*

सार

इस अध्ययन का उद्देश्य विभिन्न गणितीय कौशलों/क्षमताओं में कक्षा 5 के छात्रों की शैक्षणिक उपलब्धि के अंतर का पता लगाना है। उपलब्धि अंतराल उस अतंर को संबोधित करता है जो एक कक्षा विशेष के छात्रों से अपेक्षित होता है तथा उस कक्षा विशेष के छात्रों की उपलब्धि होती है। इस अध्ययन में गणित विषय के शैक्षिक उपलब्धि के अंतर को अध्ययन किया गया है। इसमें निम्न गणितीय कौशल/क्षमताओं पर विचार किया गया है— संख्या अवधरणा, जोड़, घटाव, गुणा, भाग, ज्यामिति, माप, समय, कैलेंडर, घन और पैटर्न। यह अध्ययन एक प्रायोगिक शोध का हिस्सा है जिसमें कक्षा 5 के छात्रों ने भाग लिया। विभिन्न गणितीय कौशलों/क्षमताओं में शैक्षणिक उपलब्धि के अंतर को खोजने के लिए गणितीय/क्षमताओं पर एक परीक्षण प्रशासित किया जिसमें सभी प्रतिभागियों की मापन और कैलेंडर में शैक्षणिक उपलब्धि में अंतर पाया गया है। 96% छात्रों की संख्या अवधरणा और गुणन तथा 80% छात्रों की शेष गणितीय कौशल/क्षमताओं में अंतर पाया गया। शोध परिणामों मे यह देखा गया कि मूल्यांकन किए गए 11 कौशलों/क्षमताओं में से कुल प्रतिभागियों में से 70% से अधिक 5 गणितीय कौशल/क्षमताओं में श्रेणी-1 स्तर तक भी नहीं पहुंचे हैं। इस उपलब्धि अंतर के कारण उच्च श्रेणी की कक्षा में पढ़ने वाले छात्रों को गणित सीखने के लिए संघर्ष करना पड़ता है। इसलिए विद्यालयी शिक्षा के प्रारंभिक चरण में इनकी पहचान करने और जल्द से जल्द इस अंतर को कम करने की आवश्यकता है।

Introduction

Elementary stage of education is the foundation for later learning and hence every country wants to strengthen its elementary education. Hence, quality assurance in elementary education is a matter of global concern. Towards achieving this goal, the United States department of Education (2002) initiated NCLB Act, 2001 (No Child Left Behind Act, 2001, as cited in Bhowmick, 2014) and Response to Intervention (RtI) programme in 2009 (Gersten et al., 2009). India has taken steps through different national level agencies like NCERT, RIE, State level agency like SCERT and district level agency like DIET to bring quality to elementary education. Initiatives are taken in the form of legal acts like RTE-2009 (Right to Free and Compulsory Education Act. 2009, Government of India 2009) and Rights of Persons with Disabilities Act (RPwD, 2016, Government of India 2016) to ensure quality of education for every

child in the elementary school. Different committees and policies at national level like NPE 1986 (MHRD 1986), POA 1992 (MHRD 1992) and various documents through NCERT like MLL 1991 (NCERT 1991); NCF 1975 (NCERT 1975), NCF 2000 (NCERT 2000) and NCF 2005 (NCERT 2005); surveys – NAS 2014 (NCERT 2014), NAS 2015 (NCERT 2015), NAS 2017 (NCERT 2017) have reiterated the commitment of the country to quality elementary education in bringing desired learning outcome in all school subjects. But till now the quality in elementary education has remained elusive not only for India but also at the global level (OECD, 2018). One of the reasons for this could be academic achievement gap of the elementary school students in various school subjects.

Academic Achievement

When the term achievement is used in the field of education, it refers to academic achievement. The term academic achievement refers to the degree of success by the students in the curricular areas or the amount of knowledge derived from learning in the classroom. Thus, academic achievement is the end product of all educational efforts (Sangtam, 2014). It is also discussed in the study of Paulpandi and Govindharaj (2017) and (Academic achievement, n.d.) that academic achievement is the outcome of education and is extended to which a student, teacher or institution achieves in their short and long-term educational goals.

Academic Achievement Gap

There are different ways to define achievement gap. Some of these definitions are discussed here. Achievement gap may occur in social, political, economic and education with respect to ethnic group, national level or international level. Bjorklund-Young and Plasman, (2019) defined achievement gap as the percentage of students who do not reach academic proficiency at each grade level. There are several ways to measure academic achievement of a student. But most common ways to measure academic achievement is examination or continuous assessment. There is no general agreement on how it is measured in the best way (Paulpandi and Govindharaj, 2017). As per Alberta Education (2008), students do not need to have mastered all of the learning outcomes at a specific grade level curriculum. So, to find the achievement level of that curriculum, a cut score may be set for acceptable standard on a provincial achievement test (approximately 50 per cent).

Need of the Study

There are so many roles and uses of mathematics in day-to-day life, cultural and moral development, development of living standards, living in modern society (Fatima, n.d), as well as it is inextricably linked to future career opportunities and also take an important role in the level of the students' general learning acquisitions (Khair, Khairani and Elrofai, 2012). So, parents, teachers, school and different educational agencies at district, state and national level are putting maximum effort to reach their educational goal or achievement. But it is seen in various educational surveys and achievement data over the years that students have not reached the expected level of learning achievement in various subjects especially in mathematics (NCERT, 2017). After analysis and review of studies (Gafoor and Kurukkan, 2015; Acharya, 2018; Boruah, 2018) it was found that academic achievement gap in various subjects especially in mathematics, is the main cause behind this fact and the term gained widespread attention after the initiation of the No Child Left Behind Act, (NCLB Act, 2001, cited in Bhowmick, 2014). It should be remembered that, to find the root cause of the above problems, it is not sufficient to find the academic achievement gap in mathematics but also the achievement gap in different mathematical skills/abilities. So, it is felt that there a is need to find the academic achievement gap in different mathematical skills/abilities and here Grade V students are considered because this grade is a bridge between primary stage and upper primary stage leading to the critical secondary stage.

Operational Definition

Academic Achievement Gap

Academic achievement gap refers to the gap or difference between academic achievement which should be expected from the students according to their grade position, that is Grade V and academic achievement which is found in their performance in different mathematical skills/abilities based on a mathematical test administered in the study.

Here, although students' current position is in Grade V, the mathematical test was administered at the beginning of the session. So, all Grade V students' current academic achievement in different mathematical skills are expected to be at Grade IV. If a student's academic achievement was found below the Grade IV in any mathematical skills/abilities, then it is considered

that the student has an academic achievement gap in that skill/ ability.

Mathematical Skills/Abilities

Here mathematical skills/abilities refer to eleven skills in mathematics of Grade V students based on Grade I to Grade IV mathematics curriculum of West Bengal Board of Primary Education. These skills/abilities are number concept, addition, subtraction, multiplication, division, geometry, measurement, time, calendar, money and pattern.

Objective

To identify the academic achievement gaps in different mathematical skills/abilities of Grade V students.

Research Question

Are there any academic achievement gaps in different mathematical skills/abilities of Grade V students?

Method

The present study was a part of an experimental research which is going on in RIE (NCERT), Bhubaneswar under Utkal University, Bhubaneswar, Orissa. The pre-test data of this experimental research was taken to address the above objective or research question.

Participants

All Grade V students (25 students) of a school in West Bengal that was selected through purposive sampling method were the participants of the current study.

Tool or Research Instrument

A Criterion-referenced test in mathematics developed for the study was used for data collection. This tool was developed on eleven mathematical skills/abilities based on Grade I to Grade IV mathematics curriculum of West Bengal Board of Primary Education. These eleven skills/abilities were number concept, addition, subtraction, multiplication, division, geometry, measurement, time, calendar, money and pattern. There are 556 items in the test. Out of these items, 92 items were from number concept, 41 items from addition,49 items from subtraction, 43 items from multiplication, 62 items from division, 60 items from

geometry, 42 items from measurement, 53 items from time, 50 items from calendar, 35 items from money and 29 items from pattern. The items for each skill/ability were collected from the mathematics textbooks of Grade I to Grade IV.

The tool was standardised by establishing the reliability through test-retest method and content validity was checked through a panel of experts. For administration, there is no time limit to complete the test and students can skip items if they are unable to respond. One score is given for right response for each item and thus maximum score possible is 556 and a cut off score (50%) was decided on the basis of MLL (Minimum Level of Learning) (NCERT, 1991), Alberta Education (2008) and a panel of experts' views for achieving a specific grade level in different mathematical skills/ abilities.

Procedure of Data Collection

After obtaining permission from the Head Teacher of the selected school, parent consent was obtained from all the parents of the Grade V students for engaging them in the study. Once the date for the test was fixed in consultation with the subject teacher, participants were given detailed instruction about the test. The test was administered in group under the invigilation of the teacher and the investigator. To avoid copying by participants, the test booklet was divided into four parts of four, three and two skills in each booklet. Care was taken to see that no two students sitting adjacent got the same booklet. Sufficient time was given to the students to complete the test. It took a minimum of four to a maximum of six sessions to complete the test by all the students. After completing the test, the response sheets were collected.

Data Analysis

The response sheets were scored and data were tabulated in the data tabulation sheet. The data tabulation sheet was prepared for each student and each data tabulation sheet contains 11 tables for 11 skills/abilities. The data tabulation sheet was prepared in such a way that all 556 items were entered skills/abilities wise (11 skills/abilities) as well as grade wise (Grade I, II, III, IV). Thus, by a glance at the sheet it is understood clearly, how many responses were correct in skills/abilities wise and grade wise.

The data tabulation sheet of each student was analysed on the basis of cut off marks (50 per cent). If a student obtained greater

or equal to cut off mark of any grade of any mathematical skill/ ability, then it was considered that the student achieved up to this grade in that particular mathematics skill or ability. In this way, skill or ability wise achievements were identified.

(For example, the analysis for one skill is given here— in addition, there are total 41 items. Out of 41 items, 8 items are from Grade I, 8 items from Grade II, 8 items from Grade III and rest 17 items from Grade IV. Suppose in this skill or ability, a student obtains 5 marks (62.5% ≥ 50%) in Grade I, 6 marks (75% ≥ 50%) in Grade II, 0 marks (0% < 50%) in Grade III and also 3 marks (17.65% < 50%) in Grade IV. It is considered that this student achieved up to Grade II in addition and also it is concluded that the current position of this student is Grade IV but actual achievement is Grade II in addition. Hence, the achievement gaps are Grade III and IV for this student).

Analysis and Interpretation

After analysis of the collected data, the results in detail are depicted in Table 1.

Table 1

Actual Grade Position (Achievement) of Grade V Students in different Mathematical Skills/Abilities (Total number of Participants N = 25)

S.No.	Name of the skills/ abilities	Achievement below Grade I		Achievement up to Grade I		Achievement up to Grade II		Achievement up to Grade III		Achievement up to Grade IV		Achievement gap	
		Number of students	*Percentage (%)*	*Number of students*	*Percentage (%)*	*Number of students*	*Percentage (%)*	*Number of students*	*Percentage (%)*	*Number of students (n)*	*Percentage (%)*	*Number of students (N-n)*	*Percentage (%)*
1.	Number Concept	4	16	13	52	3	12	4	16	1	4	24	96
2.	Addition	0	0	3	12	4	16	13	52	5	20	20	80
3.	Subtraction	7	28	9	36	1	4	2	8	6	24	19	76

4.	Multi-plica-tion	18	72	0	0	0	0	6	24	1	4	24	96
5.	Divi-sion	20	80	0	0	0	0	2	8	3	12	22	88
6.	Geom-etry	0	0	0	0	18	72	2	8	5	20	20	80
7.	Mea-sure-ment	12	48	13	52	0	0	0	0	0	0	25	100
8.	Time	18	72	0	0	0	0	4	16	3	12	22	88
9.	Calen-dar	20	80	0	0	2	8	3	12	0	0	25	100
10.	Money	9	36	10	40	0	0	1	4	5	20	20	80
11.	Pat-tern	18	72	5	20	0	0	0	0	2	8	23	92

Table 1 depicts Grade V Mathematics skills/abilities that are divided into 11 skills/abilities and actual achievement of the students in these 11 skills/abilities are divided into five levels as achievement below Grade I, achievement up to Grade I, achievement up to Grade II, achievement up to Grade III and achievement up to Grade IV. Since the test was taken at the beginning of the session, all 25 Grade V students' achievement in the above eleven skills is expected to be at Grade IV. If any student's actual achievement is below the Grade IV in any mathematical skills/abilities, then it is considered that the student has an achievement gap in that skill/ability.

The table presents that all the participants of the study have academic achievement gap in measurement and calendar. Out of the 25 students, one student has no academic achievement gap in number concept and multiplication. Eight per cent students have no academic achievement gap in pattern while 12 per cent students have no academic achievement gap in division and time. 20 per cent students have no academic achievement gap in addition, geometry and money, with 24 per cent students having no academic achievement gap in subtraction.

Major Findings and Discussion

Results, showed that all the students had academic achievement gap in measurement, calendar; 96 per cent students in number

concept, multiplication; 92 per cent in pattern; 88 per cent in division, time concept; 80 per cent in addition, geometry, money concept and 76 per cent in subtraction.

Surprisingly, more than 70 per cent of the total participants did not reach up to Grade I academic achievement level in 5 mathematical skills/abilities out of the 11 skills/abilities assessed.

The findings showed a clear picture that most of the students have academic achievement gap in every mathematics skill/ability assessed in the study. The participants though students of Grade V, their actual academic achievement in different mathematical skills/ abilities were below Grade V. This big academic achievement gap was also observed by NAS (2017) report (NCERT, 2017). As per the report only 54.7 per cent Grade V students of West Bengal had given 0 to 50 per cent correct answers in Mathematics and average achievement of Grade V students of West Bengal in Mathematics was only 48 per cent. As per PISA (2018) findings, there exists huge achievement gap not only in Mathematics but also in language and Science. The results remained unchanged between 2015 and 2018 in PISA survey (OECD, 2018). In ASER (2018) report, it is seen that only 28.1 per cent students of Grade III are able to do at least subtraction and 28.1 per cent students of Grade V are able to do division and these results are unchanged or slightly changed from 2016 to 2018 in overall India. Specifically for West Bengal only 19.4 per cent Grade V students were able to do subtraction but could not do division (Pratham, 2019). The study of Roy, Mitra and Ray (1995 cited in Talukdar, 2013) it was found that only 20 per cent Grade IV students of 15 districts of West Bengal secured minimum expected score. A study of Jalan and Panda (2010) found that average score in Mathematics across the six districts of West Bengal is 27.6 per cent which is below the State-mandated passing percentage of 34 per cent. In a study of Muthukrishnan, Kee and Sidhu (2019), huge achievement gap is reported for the six-year-old pre-school children in addition skills.

Educational Implication

- School functionaries as well as all stakeholders can use this procedure to improve teaching and learning in elementary schools focusing on developing grade appropriate skills in all school subjects.

- Teachers and school administration can look for areas where students do well and use the information to motivate students to improve in areas in which they are deficit.
- The finding of the study is of a school in West Bengal. More or less similar situation may be existing in every State. Taking necessary steps to identify this academic achievement gap in schools would go a long way in helping students overcome this gap and progress in learning.

Conclusion

As a result of the gap of the magnitude identified in the study, students face difficulties in learning Mathematics that in turn lead to develop fear for the subject leading to deterioration in quality of learning. Hence, this alarming situation demands identification of academic achievement gap in different skills/abilities at elementary stage and take necessary steps to bridge the gap before the gap is detrimental.

References

Acharya, B.R. 2018. Factors Affecting Difficulties in Learning Mathematics by Mathematics Learners. *International Journal of Elementary Education.* Vol. 6, No. 2. http://www.sciencepublishinggroup.com/j/ijeedu

Alberta Education. 2008. *Grade Level of Achievement Reporting: Teacher and Administrator Handbook.* As Represented by the Minister of Education, Alberta, Canada

Bhowmick, N. 2014. Investigating the Achievement Gap in Mathematics: An Analysis of Fifth Grade School Data. A Dissertation Submitted to the Faculty of the Graduate School of the University of Minnesota for the Degree of Doctor of Education.

Bjorklund-Young, A. and J. Plasman. 2019. Reducing the Achievement Gap: An Empirical Analysis of Middle School Math Performance in Six States and Washington, D.C.

Boruah, P.J. 2018. Problems Faced By the Students and Teachers in Learning and Teaching Mathematics in Schools: A Study on Class X Students and Teachers of Nazira Sub-Division of Sibsagar District of Assam. *IOSR Journal of Humanities and Social Science (IOSR-JHSS).* Vol 23, No. 7. www.iosrjournals.org

Collins English Dictionary. 2019. Definition of Achievement. Retrieved from https://www.collinsdictionary.com

Fatima, R. (n.d.). Role of Mathematics in the Development of Society. Retrieved on 5th December from www.ncert.nic.in/pdf-files/Final-

Artical-Role%20of%mathematics%20in%20the%20Development%20ofsociety-NCERT-pdf

Gafoor, K.A. and A. Kurukkan. 2015. Learner and Teacher Perception on Difficulties in Learning and Teaching Mathematics: Some Implications. Department of Education University of Calicut, Paper Presented in National Conference on Mathematics Teaching-Approaches and Challenges, On 21st and 22nd December 2015, Regional Institute of Education, Mysore, Karnataka, India

Gersten, R., S. Beckmann., B. Clark., A. Foegen., L. Marsh., J.R. Star and B. Witzel. 2009. *Assisting Students Struggling with Mathematics: Response to Intervention (RtI) for Elementary and Middle Schools (NCEE 2009-4060).* Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education, Retrieved from http://ies.ed.gov/ncee/wwc/publications/practiceguides/.

Government of India. 2009. *The Right of Children to Free and Compulsory Education Act, 2009*. No. 26th August, 2009, Legislative Department, Ministry of Law and Justice, New Delhi

———. 2016. *The Rights of Persons with Disabilities Act, 2016*. No. 49 of 2016, 28th December, 2016, Legislative Department, Ministry of Law and Justice, New Delhi.

Jalan, J. and J. Panda. 2010. Low Mean and High Variance: Quality of Primary Education in Rural West Bengal. Centre for Studies in Social Sciences. Calcutta.

MHRD. 1986. National Policy on Education 1986. Department of Education, MHRD, New Delhi, India.

———. 1992. Programme of Action 1992. Department of Education, MHRD, New Delhi, India.

Muthukrishnan, P., M.S. Kee. and G.K. Sidhu. 2019. Addition Error Patterns Among the Preschool Children. *International Journal of Instruction.* Vol. 12, No. 2. pp. 115–132. https://doi.org/10.29333/iji.2009.1228a

National Council of Educational Research and Training. 1975. *The Curriculum for Ten-Year School: A Framework*. NCERT, New Delhi, India.

———. 1988. *National Curriculum for Elementary and Secondary Education*: *A Framework*. Revised Version. NCERT, New Delhi, India.

———. 1991. *Minimum Levels of Learning at Primary Stage*. NCERT, New Delhi, India.

———. 2000. *National Curriculum Framework for School Education*. NCERT, New Delhi, India.

———. 2005. *National Curriculum Framework 2005.* NCERT, New Delhi, India.

———. 2014. *National Achievement Survey, 2014, Class V (Cycle 3).* Educational Survey Division. NCERT, New Delhi, India.

———. 2015. *What Students of Class V Know and Can Do, A summary of India's National Achievement Survey, Class V (Cycle 4).* Educational Survey Division. NCERT, New Delhi, India.

———. 2017. *National Achievement Survey, 2017 Class: 3, 5 and 8, West Bengal State Learning Report.* Educational Survey Division. NCERT, New Delhi, India.

OECD. 2018. *PISA 2018 Results Combined Executive Summaries*, Vol. I, II and III, OECD, Paris.

Paulpandi, B. and P. Govindharaj. 2017. Academic Achievement in Mathematics Subject Among Secondary School Students in Madurai. Tamil Nadu, *International Journal of Indian Psychology*. Vol. 4, (s), DIP: 18.01.108/20170403, DOI: 10.25215/0403.108

Pratham. 2019. *Annual Status of Education Report 2018*. B 4/54 Safdarjung Enclave, New Delhi 110029

Sangtam, T.Y. 2014. *A Study of Academic Achievement, Study Involvement and Emotional Maturity of Secondary School Tribal Students of Nagaland*. Department of Education, Bangalore University, Bangalore. Retrieved from www.ncert.nic.in/departments/nic/der/publication/pdf

Talukdar, R.R. 2013. Quality of Elementary Education among the Tribal Children of Meghalaya. An Analytical Study. Retrieved from ncert.nic.in/departments/nic/der/publication/pdf/talukdar.pdf

Wikipedia contributors. (n.d.). *Academic achievement*. In Wikipedia, the Free Encyclopaedia.Retrieved from 5th December, 2019 from en.wikipedia.org/wiki/Academic achievement.