Research Article

Status of Science education and ICT at Secondary school stage in Aspirational Districts of North India: An Analysis of NAS 2021 District Report

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Abstract

This study aimed to examine the status of science education and ICT at the secondary school stage in the Aspirational Districts of North India. For this study, the districts report card of the National Achievement Survey (NAS) District Report 2021, which was considered a data source for 22 aspirational districts of six states and one Union Territory in North India. The secondary data were statistically analysed using frequencies, percentages, and averages. Finding of the study reveals that (1) students' performance level decreases as they progress from the basic level to the advanced level, and not satisfactory (2) aspirational districts of North India show positive up to some extent developments in science education for girls, (3) the current state of science education indicates that students are not achieving the expected learning outcomes, and (4) the status of ICT is not in a good position in terms of accessibility to digital devices, particularly regarding internet connectivity and the adequacy of audio-visual resources in all aspirational districts of North India. Study concluded that the status of science education and ICT are not in good position in most of the aspirational districts of North India. Therefore, more collective efforts are needed to improve science education and ICT integration at the secondary school stage.

Keywords: Aspirational Districts, ICT, Science education, Learning Outcomes, Girls Education

Introduction

ICT in education is generally considered a discipline, a set of resources, and a key skill. Within these three broad areas, ICT offers enormous benefits to society (Abdullai, 2013). The impact of technology on students' achievement in science and the development of technological skills, pedagogical beliefs, and ICT capabilities is increasing (Lee et al., 2017). The use of digital simulations in learning Earth sciences has been found to have a positive impact on understanding relative chronology concepts (Nafid et al., 2018). ICT-rich environments provide a range of possibilities that enhance science learning (Rocha Fernandes et al., 2019). The use of technology in education can support the teaching-learning process at various stages (NEP 2020).

ICT and Learning Outcomes in Science education

Science education necessitates innovative techniques that enable students to grasp dynamic scientific concepts. Conventional teaching

methods need technological updates to enhance learning efficiency through psychological features. Therefore, the integration of ICT in science widely embraced by teachers and students. Technology is crucial for comprehending complex scientific terms and processes deeply. ICT-integrated learning techniques motivate students, foster collaboration, and encourage innovative thinking by providing opportunities to develop their own ideas. Furthermore, interactive multimedia learning applications enrich the learning process, improving the ability to present information systematically to achieve learning outcomes. For instance, Augmented Reality (AR) enhances motivation by integrating multimedia elements with theoretical concepts. AR merges virtual information with the real environment in real-time, enhancing user perception through visual, auditory, and tactile feedback, thereby exceeding traditional learning expectations (Sinha & Kumar, 2020).

Girls in science education

Science education should be leveraged as a tool for social change to reduce the socio-economic divide (National Focus Group on Science Education, 2006). In particular, providing quality education to girls from socio-economically disadvantaged groups will significantly enhance overall educational standards (NEP, 2020). Thus, understanding the progress of girls in science education at the secondary level is important.

Aspirational Districts in North India

To maintain and uplift the human development index and enhance the socio-economic conditions from the grass-root level to a higher level for national development (Puri, 2020), Niti Aayog launched the Aspirational District Programme (ADP) (UNDP, 2020). Subsequently, an Aspirational development programme aims to transform under-developed districts across India. The programme Centre's around five primary themes: Health & Nutrition, Education, Agriculture & Water Resources, Financial Inclusion & Skill Development, and Basic Infrastructure to directly impact the quality of life at different stages and integrate the socio-economic productivity of citizens. An aspirational district involves 124 (16.91 per cent) out of 733 total districts of India (Maps of India, 2021) which is the most under-developed district in phase-I & phase II across the country (MyMSME, n.d). If we look into North Indian States/UTs excluding Delhi, Rajasthan, Uttarakhand, Uttar Pradesh, Punjab, Himachal Pradesh, Jammu & Kashmir and the Haryana States having Aspirational District(s) as shown in Table 1.

Table-1: Aspirational Districts in North India

Region	State	Total Districts in State/UT	Total Aspirational Districts	State wise %
North India	Rajasthan	33	6 (Baran, Dholpur, Jaisalmer, Karauli, Sirohi and Barmer)	18.18
	Uttarakhand	13	2 (Haridwar, Udham Singh Nagar)	15.38
	Uttar Pradesh	75	8 (Bahrich, Balampur,Chandauli, Chitrakoot, Fatepur, Shraswasti, Shiddarthnagar andSonabhadra)	10.67
	Punjab	22	2 (Ferozpur, Monga)	9.09
	Jammu and Kashmir	22	2 (Baramullah, Kupwara)	9.09
	Himachal Pradesh	12	1 (Chamba)	8.33
	Haryana	22	1 (Nuh)	4.54

(Source data: NAS-2021 Districts Report Card, https://nas.gov.in/report-card/2021)

Table 1 depict that Rajasthan has the highest percentage of Aspirational Districts in North India. Uttarakhand is the second highest 15.38 per cent of aspirational Districts among all the North Indian. While Uttar Pradesh, Punjab, Himachal Pradesh, Jammu & Kashmir and Haryana have a low percentage of Aspirational Districts(s) comparatively to Rajasthan and Uttarakhand. It can be state that including other aspirational districts in percentage of North India, districts of Rajasthan, Uttarakhand and Uttar Pradesh need to give more intervention programme or teaching-learning activities. Hence, these aspirational districts need more academic, administrative, financial and other related resources and outcomes based activities.

Educational profile of the Aspirational Districts

The schools and teachers in different management schools in Aspirational Districts of North India is presented in Table 2. This data helps to understand the actual position of schools in the mentioned aspirational districts.

Table-2: Educational profile of the Aspirational Districts

State/UTs	Total Aspirational Districts	Total No. Schools	Total No. Teachers	SGS	TSGS	GAS	TGAS	CGS	TCGS	PURS	TPURS
Rajasthan	Baran	2123	13253	1594	8065	-	-	4	79	525	5109
	Dhaulpur	1816	13114	1144	7201	-	-	3	46	669	5867
	Jaisalmer	1626	7866	1302	5392	-	-	5	122	319	2352
	Karauli	2186	15462	1452	8203	-	-	2	54	732	7205
	Sirohi	1394	9353	999	6000	-	-	3	66	392	3287
	Barmer	5532	27472	4822	21075	-	-	4	110	706	6287
Uttarakhand	Haridwar	2047	14549	946	4045	92	911	4	145	1005	9448
	Udham Singh Nagar	2129	16033	1137	4508	68	605	3	70	921	10850
Uttar Pradesh	Bahrich	3765	19588	2876	12672	57	646	4	38	828	6232
	Balampur	2336	10341	1850	7071	33	384	2	50	451	2836
	Chandauli	2056	14920	1230	7386	81	785	3	112	742	6637
	Chitrakoot	1685	8735	1295	5856	45	290	2	44	343	2545
	Fatepur	3628	19047	2189	9963	142	1027	2	25	1295	8032
	Shraswasti	1370	6890	1018	4248	19	239	2	24	331	2298
	Shiddarth nagar	3030	14783	2297	9387	78	835	2	33	653	4525
	Sonabhadra	2765	13876	2123	8075	16	210	4	100	622	5491
Punjab	Ferozpur	1100	9322	841	4786	10	88	5	136	244	4312
	Monga	857	9308	595	4385	12	108	1	20	249	4795
Jammu and Kashmir	Baramullah	2401	14176	1975	8967	-	-	3	53	423	5156
	Kupwara	2177	11471	1844	7652	-	-	1	3	332	3816

State/UTs	Total Aspirational Districts	Total No. Schools	Total No. Teachers	SGS	TSGS	GAS	TGAS	CGS	TCGS	PURS	TPURS
Himachal Pradesh	Chamba	1847	7880	1671	6219	-	-	7	157	169	1504
Haryana	Nuh	1118	6886	941	4727	-	-	1	19	176	2140
Total		48988	284325	36141	165883	653	6128	67	1506	12127	110724

(Where, State Govt. Schools= SGS, TSGS= Total No. of Teachers in Schools, Govt. Aided Schools=GAS, TGAS= Total No. of Teachers in Govt. Aided Schools, Central Govt. Schools=CGS, TCGS= Total No. of Teachers in Central Govt. Schools, PURS= Private Unaided Recognized Schools and TPURS =Total No. of Teachers in Private Unaided Recognized Schools; Note: - means there is no Govt. Schools established in these districts and teachers were not appointed). (Source data: NAS-2021 Districts Report Card, https://nas.gov.in/report-card/2021)

Table 2 shows that teachers, different management schools are available in the Aspirational Districts of North India. While less number of Government aided and Central schools available in these districts. It can be stated that teachers in these Aspirational districts contributing their educational services in State Government and Private Unaided Recognized Schools is more. In this scenario, State Government can create the integrated approach of resource sharing with other management schools.

Educational Indicators for Aspirational Districts

Out of all focused themes of Aspirational Districts, 30 per cent weightage was given to the education sector. The following eight key indicators have been identified for the improvement of education in Aspirational Districts:

- Indicator 1(a): Transition from primary to upper Primary
- Indicator 1(b): Transition from upper primary to secondary
- Indicator-2: percentage of schools with functional girls' toilets
- Indicator 3: Learning outcomes (Mathematics and Languages from class three to eight)
- Indicator 4: Female literacy
- Indicator 5: percentage of schools with functional drinking water facilities
- Indicator 6: percentage of schools with functional electricity facility at secondary level
- Indicator 7: percentage of elementary schools complying with Right to Education specified PTR
- Indicator 8: percentage of schools providing textbooks to children

Samagra Siksha Flagship Programme for Aspirational Districts

The Samagra Siksha Flagship Programme aims to transform Aspirational Districts through the implementation of ICT and digital initiatives. These initiatives will specifically target students in grades six to twelve. Hence, the ability to get hardware such as tablets, laptops, notebooks, and integrated teaching learning devices, along with open source operating systems, as well as hardware, software, training, and resource support. This would encompass assistance for digital whiteboards, intelligent classrooms, virtual classes, and DTH channels, allocated proportionally based on the number of authorised schools. Projects that involve community participation will be given priority, particularly those that are eligible for schools. Therefore, the status of ICT at the secondary stage in school is presented in terms

of accessibility of digital devices in the schools, internet connectivity and adequacy of Audio-Visual resources.

Literature Review

Adeyemo (2010) investigated the impact of ICT on the teaching and learning of physics, revealing significantly enhances the learning experience and makes the subject more engaging for students. Byker (2014) highlighted the lack of empirical research on ICT in Indian elementary schools, which obstructs India's efforts to provide education and prepare children with 21st-century skills. Das (2012) emphasized the critical role of understanding and leveraging ICT for social and economic progress, stressing the necessity of embedding ICT-based resources in educational systems to equip students with necessary skills.

Paul and Mondal (2012) analyzed the role of ICT in enhancing the quality of school education and found that ICT can predict future educational technologies and improve education quality, provided that proper infrastructure is in place. Simin (2015) corroborated this by analyzing teachers' perceptions of ICT integration's effectiveness, highlighting that well-equipped ICT tools and professional development are crucial for successful technology-based teaching and learning. Agrahari and Singh (2013) focused on the impact of ICT on student achievement in chemistry, revealing the necessity of lifelong education and the importance of modern educational technologies, in meeting the growing demand for scientific knowledge.

Ruiz et al. (2014) examined the influence of technologies in science teaching on gender differences and found that ICT tools improved motivation and learning scores, particularly for women. Shanmugam and Balakrishnan (2019) also highlighted the positive impact of ICT on student motivation in learning science. Aboderin and Bamisile (2021) examined ICT skills significantly enhanced students' perceptions of the influence of ICT in science teaching and learning practices.

Sharma and Sharma (2017) studied the effectiveness of ICT in science teaching and found that students enjoyed ICT in lessons and useful for teachers. Roy and Sehrawat (2018) conducted an experimental study on the effectiveness of ICT-enabled classrooms for science students and showed that students taught through video modules performed better and improving academic achievement. Mann and Mohanty (2018) examined the status of technological infrastructure and training needs for ICT among school teachers and noted that ICT use was limited, with few motivated teachers using personal ICT resources for teaching. Kumar et al. (2020) analysed the socio-economic status of people in aspirational districts for inclusive growth and revealed the need for priority interventions. Kumar et al. (2021) investigated the effectiveness of skill development training programs in aspirational districts and found that the majority of trainees perceived an improvement in their knowledge and skills. Saha (2022) studied the issues and status of teacher management in the aspirational districts and revealing it is difficult task. Finally, Igboanugo et al. (2020) studied the efficacy of ICT integration in teaching methods for effective chemistry curriculum delivery and showed that significantly enhanced curriculum delivery.

Based on a literature review, ICT significantly enhances learning experiences and student engagement in science education. However, persistent barriers such as a lack of resources, training, and infrastructure hinder the effective implementation of ICT in learning science. No study has been conducted on ICT and science education in the Aspirational Districts. Therefore, this study examined the

status of ICT and science education at the secondary school stage, especially in the Aspirational Districts of North India.

Operational definition

- **Science Education:** It means, the teaching-learning of science in classroom environment to cultivate knowledge, develop scientific temper, problem solving and critical thinking and ability to solve the problems in real life.
- **Information and communication Technology (ICT)**: ICT, in the context of present study, means employing technology and related resources for teaching-learning process.
- **Aspirational Districts**: Here, aspirational District can be defined as districts which are affected by poor socio-economic factors including education in different States/ UTs of India.

Research Questions

- What is the status of science education at the secondary school stage in the aspirational districts of North India?
- What is the status of ICT at the secondary school stage in the aspirational districts of North India?

Objectives of the Study

- To examine the status of students in science at the secondary school stage in Aspirational Districts of North India.
- To study the status of ICT at the secondary school stage in Aspirational Districts of North India.

Delimitations

- The present study comprises student data at the secondary stage from the National Achievement Survey 2021, district report card.
- The present study comprises data on science education and ICT in schools at the secondary stage from the National Achievement Survey 2021, district report card.
- The present study comprises district reports belonging to aspirational districts of North India as given in the National Achievement Survey 2021, district report card.
- In the present study, the performance of students and learning outcomes is considered as the status of their science education.

Methodology

This study employs a quantitative research methodology, utilizing secondary data. Data on science education and ICT were collected from the National Achievement Survey 2021 District Report Card, prepared by NCERT, through an online visit to the National Achievement Survey Portal of the Department of School Education and Literacy, Ministry of Education, Government of India. The researcher subsequently organized, tabulated, and statistically analyzed the secondary data using descriptive statistics, including frequencies, percentages, and averages.

Status of science education at secondary school stage

The status of science education at the secondary stage is categorized into the following three sections: performance levels of students in science education, performance levels of girls in science education, and learning outcomes of students in science education, presented in Table 3, Table 4 and Table 5 respectively.

Table-3: Performance of students in Science education

State/UTs	Aspirational Districts in North India	District wise Performance in Science education (%)	% of students by performance level in Science education in Aspirational Districts			
			BB	BS	PR	AD
Rajasthan	Baran	37	66	23	11	0
	Dholpur	56	18	29	37	16
	Jaisalmer	38	64	21	13	2
	Karauli	43	46	32	20	2
	Sirohi	43	49	28	20	3
	Barmer	42	52	27	19	2
Uttarakhand	Haridwar	34	75	17	8	1
	Udham Singh Nagar	33	80	13	5	1
Uttar Pradesh	Bahrich	29	90	9	1	0
	Balampur	31	87	9	3	1
	Chandauli	32	35	46	16	4
	Chitrakoot	43	30	35	22	12
	Fatepur	32	80	16	4	0
	Shraswasti	31	85	13	1	0
	Shiddarthnagar	33	80	15	5	0
	Sonabhadra	32	84	12	4	0
Punjab	Ferozpur	50	34	25	33	8
	Monga	47	38	34	25	3
Jammu and Kashmir	Baramullah	60	69	22	8	1
	Kupwara	43	30	35	22	12
Himachal Pradesh	Chamba	32	64	26	7	2
Haryana	Nuh	31	74	18	8	1
Overall performance		37.36	60.45	22.95	13.27	3.22

Where BB=Below Basic level, BS= Basic level, PR= Proficiency level and AD= Advanced level

(Source data: NAS-2021 Districts Report Card, https://nas.gov.in/report-card/2021)

This table 3 presents the performance in science education across 22 aspirational districts of North India. Each district's performance is broken down into four categories: Below Basic (BB), Basic (BS), Proficient (PR), and Advanced (AD). The performance in science education across various aspirational districts varies from (31 per cent to 60 per cent). In the three districts, 16 per cent of students from Dholpur, 12 per cent from Kuphwara, and 12 per cent from Chitrkoot demonstrated advanced performance in science education.

While the performance levels in the other 19 districts ranged from (1 per cent to 8 per cent). Student's proficiency in science education varied between (22 per cent and 37 per cent) in the five aspirational districts. These were 37 per cent of students from Dholpur, 33 per cent of students from Ferozpur, 25 per cent of students from Monga, 22 per cent of students from Chitrkoot, and likely 22 per cent of students from Kuphwara. In the other 17 districts, the percentage of students performing at the proficiency level ranged from 1 per cent to 20 per cent. In the five aspirational districts, students' basic performance levels in science education ranged from (22 per cent to 37 per cent). These were 37 per cent of students from Dholpur, 33 per cent of students from Ferozpur, 25 per cent of students from Monga, 22 per cent of students from Chitrkoot, and likely 22 per cent of students from Kuphwara. While the percentage of basic-level performance in the other 17 districts varied from 1 per cent to 20 per cent, respectively. As a result, the performance level of students in science education in the thirteen aspirational districts was below-basic (64 per cent to 90 per cent), three districts had a below-basic (46 per cent to 52 per cent), and six aspirational districts had a below-basic (18 per cent to 38 per cent). The table also show that overall performance of science education across various aspirational districts is 37.36 per cent. Furthermore, the overall performance shows that 60.45 per cent students are at the below basic level, 22.95 per cent students at the basic level, 13.27 per cent students at the proficiency level, and 3.22 per cent students at the advanced level. The analysis above indicates significant differences in students' performance in science education, ranging from basic level to advanced levels. The percentage of students at each performance level decreased as they progressed from the basic level to the advanced level. While it should be increased from below basic level to advanced level. It means that the overall status of science education in the aspirational districts of north India is not in a good position. It may be due to student's attitude towards science education, teaching-learning process, and resources utilisation. Chikendu & Obikezie (2020) revealed that the attitude of students significantly impacts their science education. Therefore, there is a special need to emphasise and identify the factors behind the low percentage of proficiency and the advanced level of science education. Similarly, it needs intervention in the teaching-learning process as well as resource utilisation for better performance in science education at the secondary school stage.

Table-4: Performance and progress of girls in Science education

State/UTs	Aspirational Districts in North India	District wise performance in Science education (%)	% of performance and progress in Science education at secondary school stage of Girls		
			%	% Progress	Indicators
Rajasthan	Baran	37	39	2%	+
	Dholpur	56	57	1%	+
	Jaisalmer	38	36	2%	-
	Karauli	43	44	1%	+
	Sirohi	43	46	3%	+
	Barmer	42	44	2%	+

State/UTs	Aspirational Districts in North India	District wise performance in Science education (%)	% of performance and progress in Science education at secondary school stage of Girls		
			%	% Progress	Indicators
Uttarakhand	Haridwar	34	33	1%	-
	Udham Singh Nagar	33	32	1%	-
Uttar Pradesh	Bahrich	29	28	1%	-
	Balampur	31	29	2%	-
	Chandauli	32	31	1%	-
	Chitrakoot	32	31	1%	-
	Fatepur	32	31	1%	-
	Shraswasti	31	31	No Change	=
	Shiddarthnagar	33	32	1%	-
	Sonabhadra	32	31	1%	-
Punjab	Ferozpur	50	52	2%	+
	Monga	47	48	1%	+
Jammu and Kashmir	Baramullah	36	35	1%	=
	Kupwara	35	35	No Change	=
Himachal Pradesh	Chamba	32	32	No Change	=
Haryana	Nuh	34	35	1%	+

(Where, - sign = progress decrease, + sign = progress increase, and = sign =no change in progress) (Source data: NAS-2021 District Report Card, https://nas.gov.in/report-card/2021)

The table 4 highlights the performance and progress of girls in science education at the secondary school stage across various aspirational districts in North India. Among the all aspirational districts, 3 per cent of progress in science education found in girls of one district Sirohi district of Rajasthan, 2 per cent of progress in the science education found in girls of five districts as Baran, Jaisalmer, Barmer, Balampur, and Ferozpur, and 1 per cent of progress in science education found in girls of twelve districts as Dhopur, Karauli, Haridwar, Udham Singh Nagar, Bahrich, Chandauli, Chitrkoot, Fatepur, Shiddarthnagar, Sonabhadra, Moga and Baramillah, and there were no change found in progress in the science education in girls of five districts as kupwara, chamba and sharaswasti. Based on above results, it can be interpreted that aspirational districts of North India yet more positive developments in science education for girls. The result of the study favoured by the some other studies and reveal that girls were underperforming and underrepresented in science education in developing countries worldwide

(Ullah et al, 2021; Roberts & Huges, 2022; Fussy et al., 2023). However, the absence of progress in Kupwara, Chamba, and Shrawasti signals potential areas where educational strategies may need re-evaluation and targeted interventions to foster improvement. Therefore, policies and schemes for including students from SEDGs should focus on girls by establishing a 'Gender-Inclusion Fund' to enhance the nation's ability to offer equitable, quality education for all (NEP-2020). Overall, the progress percentages indicate both successful and stagnant regions, highlighting the need for policy recommendations to address the unique challenges faced by each aspirational district in girls' science education.

Table-5: Learning outcomes percentage of Science education

LOs	Percentage of learning outcomes in science education																					
	D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9	D_{10}	D_{11}	D_{12}	D_{13}	D_{14}	D_{15}	D_{16}	D_{17}	D_{18}	D_{19}	D_{20}	D_{21}	D_{22}
LO1	43	58	42	50	49	48	37	36	31	33	35	34	36	36	35	34	55	50	36	38	33	35
LO2	38	53	38	44	48	41	37	34	34	36	34	33	33	35	34	34	49	49	36	36	33	39
LO3	44	64	44	52	51	48	36	35	33	32	33	34	34	35	36	34	61	52	38	37	35	42
LO4	37	63	40	45	45	45	34	33	30	30	31	33	34	30	34	33	52	50	38	37	30	34
LO5	31	35	33	34	31	34	28	30	26	31	28	28	30	28	32	27	30	32	34	31	32	33
LO6	28	35	27	30	30	26	27	28	25	26	31	31	26	26	29	29	34	29	27	25	26	27
LO7	45	70	44	50	51	50	36	33	30	30	37	36	39	33	41	36	56	57	45	41	30	32
LO8	34	56	36	40	38	41	33	30	27	29	32	31	29	28	31	29	49	47	32	29	27	31
LO9	37	59	38	45	44	42	35	35	29	33	32	33	33	30	34	32	51	48	37	37	37	35
LO10	31	54	33	33	38	32	27	26	24	26	24	24	24	23	24	25	44	39	28	26	24	27

(Where D_1= Baran, D_2=Dholpur, D_3=Jaisalmer, D_4=Karauli, D_5=Sirohi, D_6=Barmer, D_7=Haridwar, D_8=Udham Singh Nagar, D_9=Bahrich, D_{10}=Balampur, D_{11}=Chandauli, D_{12}=Chitrakoot, D_{13}= Fatepur, D_{14}=Shraswasti, D_{15}= Shiddarthnagar, D_{16}= Sonabhadra, D_{17}= Ferozpur, D_{18}= Monga, D_{19}= Baramullah, D_{20}= Kupwara, D_{21}= Chamba and D_{22}= Nuh) and (Source data: NAS-2021 District Report Card, https://nas.gov.in/report-card/2021) and

Learning Outcomes: LO1 to LO10 follows as

LO1: Differential material, objects, organisms, phenomena and processes based on properties and characteristics.

LO2: Classifies materials, objects, organisms, phenomena and processes based on properties and characteristics.

LO3: Relates processes and phenomena with cause and effects.

LO4: Explains processes and phenomenon.

LO5: Analysis and interprets data, graphs and figures.

LO6: Calculate using the data given.

LO7: Uses scientific conventions to represent units of various quantities, symbols, formulae and equations.

LO8: Applies learning to hypothetical situations

LO9: Applies scientific concepts in daily life and solving problems

LO10: Derives formulae, equations and laws

Table 5 reveals that only three out of the 22 aspirational districts show more than 50 per cent to 55 per cent achievement in learning outcomes (LOs) in science

(excluding analysis and interpreting data, graphs, figures, and calculations using the data) at the secondary school level, as in Dhaulpur of Rajasthan, Ferozpur, and Monga of Punjab. In the secondary stage, the majority of students achieved less than 50 per cent success in science learning outcomes. Similarly, learning outcomes of science students are still low (Rizaki et al., 2022). Students should cultivate their scientific development, critical thinking, and problem-solving skills. NEP-2020 also emphasizes the importance of cultivating a scientific mindset among learners. The current state of science does not indicate that students are achieving the expected learning outcomes, as their performance across most districts does not exceed the expected threshold of 50 per cent. Therefore, educational institutions, researchers, and other stakeholders, such as teachers, teacher educators, and administrations, need to come together on a successive path to achieving learning outcomes in science for students in the secondary school stage.

Status of ICT at Secondary school stage in Aspirational Districts of North India.

The following table 6 presents the status of ICT at the secondary school stage in terms of accessibility to digital devices, Internet connectivity, and adequacy of audio-visual resources.

Table-6: ICT resources & adequacy in Aspirational districts

(Source: NAS-2021 District Report Card, https://nas.gov.in/report-card/2021)

State/UTs	Aspirational Districts	Students have access to digital devices in the Schools (%)	Students having Internet Connectivity at Home (%)	Heads of School responses for Adequacy of Audio-Visual resources (%)
Rajasthan	Baran	76%	50%	39%
	Dhaulpur	67%	49%	48%
	Jaisalmer	80%	62%	42%
	Karauli	66%	46%	39%
	Sirohi	87%	62%	42%
	Barmer	74%	56%	42%
Uttarakhand	Haridwar	81%	61%	38%
	Udham Singh Nagar	79%	62%	41%
Uttar Pradesh	Bahrich	70%	49%	43%
	Balampur	67%	44%	30%
	Chandauli	64%	51%	29%
	Chitrakoot	59%	41%	30%
	Fatepur	64%	48%	27%
	Shraswasti	72%	45%	28%
	Shiddarthnagar	68%	47%	30%
	Sonabhadra	66%	51%	31%

State/UTs	Aspirational Districts	Students have access to digital devices in the Schools (%)	Students having Internet Connectivity at Home (%)	Heads of School responses for Adequacy of Audio-Visual resources (%)
Punjab	Ferozpur	97%	82%	90%
	Monga	96%	77%	88%
Jammu and Kashmir	Baramullah	76%	62%	24%
	Kupwara	77%	60%	21%
Himachal Pradesh	Chamba	82%	65%	43%
Haryana	Nuh	69%	52%	43%
Overall ICT resources		**74.41%**	**55.54%**	**40.36%**

Table 6 depicts the ICT resources in terms of accessibility of digital resources, Internet connectivity, and adequacy of Audio-visual resources at the Secondary Schools stage in Aspirational districts of

North India. In the case of Aspirational Districts of North India, 80 per cent to 97 per cent of students belonging to Jaisalmer and Sirohi of Rajasthan, Haridwar of Uttarakhand, Ferozpur, and Monga of Punjab, and Chamba of Himachal Pradesh admitted that schools have digital devices. The 60 per cent to 82 per cent of Students having Internet Connectivity at home belong to Jaisalmer, Sirohi, Haridwar, Udham Singh Nagar, Ferozpur, Monga, Baramullah, Kupwara, and Chamba districts. In the others aspirational Districts of North India, 44 per cent to 56 per cent of students admitted that they have less percentage in Internet connectivity at home belongs to Baran, Dhaulpur, Karauli, Barmer, Bahrich, Balampur, Chandauli, Chitrakoot, Fatepur, Shraswasti, Shiddarthnagar, Sonabhadra and Nuh. Heads of schools of Ferojpur and Monga of Punjab showed the highest 90 per cent and 88 per cent Audio-Visual resources available in their schools at the secondary level. While Dhaulpur, Jaisalmer, Sirohi, Barmer, Udham Singh Nagar, Bahrich, Nuh, and Chamba showed 41 per cent to 48 per cent availability of Audio-visual resources, while the rest 12 Aspirational Districts Heads admitted that schools had 21 per cent to 39 per cent audio-visual resources. Furthermore, the overall ICT resources availability and adequacy shows that 74.41 per cent students have access to digital devices in the Schools, 22.95 per cent students have internet connectivity at home, 40.46 per cent heads of school admitted that adequacy of Audio-Visual resources in the respective schools. It can be stated that the status of ICT not in good position related to accessibility of digital device, particularly for internet connectivity and adequacy of audio-visual resources in all aspirational districts of North India. Similarly, Lack of ICT resources, coupled with limited internet connection and speed, has been found in the schools (Mann & Mohanty, 2018; Sahoo et al., 2022; Baruah & Mohalik, 2022). NEP-2020 states that teaching-learning should be ICT integrated at various stages of teaching-learning multidimensional subjects or discipline. Therefore, need on both ICT resources and its integration in science at secondary stage.

Conclusion

Government of India has taken positive initiatives to uplift the education status of Aspirational Districts. According to the NAS-21 district report, the status of science education among students at the secondary school stage in aspirational districts is not satisfactory. Findings indicate that approximately 30-60 per cent more intervention is required to achieve 100 per cent performance in science education for students. Furthermore, the performance of science education among girls at the secondary school stage is also not much improved. This study suggests that the available teaching-learning processes and applied resources are not student-centric. Currently, there is a need to assess the holistic development of individual learners based on their learning outcomes. Addressing this need is a major concern for various stakeholders including teachers, teacher educators, researchers, policymakers, and educational institution management. The study concludes that emphasis should be placed on an integrated approach to science education and ICT which is not presented in the Aspirational Districts of North India to achieve global standards through quality education (NEP, 2020). Therefore, educational programs developed by government organizations should incorporate science teaching-learning interventions across different phases. Initiatives in science education need to adopt an integrated pedagogical approach with ICT at both the secondary school management levels in Aspirational Districts of North India, from grassroots to leadership.

Educational Implications

- ICT based intervention studies can be conducted to enhance the status of science education in aspirational districts in North India and other aspirational districts.
- There is a necessity for gender-focused programs and related educational initiatives in aspirational districts to ensure equitable learning opportunities in ICT and science education.
- The low availability of ICT resources, particularly internet connectivity and audio-visual aids, suggests the need for substantial investment in digital infrastructure to support modern teaching and learning practices in aspirational districts.
- An ICT-integrated science curriculum can be developed to enhance learning outcomes by providing students with access to interactive and engaging educational resources.
- There is a need for continuous professional development programs for teachers in aspirational districts to equip them with effective pedagogical strategies and the skills to utilize ICT for science teaching.
- Policymakers should prioritize the allocation of resources to the aspirational districts to ensure all students have the necessary tools and opportunities to succeed in science education.

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