TEACHERS' PERSPECTIVE ON AVAILABILITY, ACCESSIBILITY, AND UTILIZATION OF DIGITAL RESOURCES IN THE SECONDARY SCHOOLS OF NORTHERN REGION OF INDIA

By

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ABSTRACT

The study explores how online and digital resources shape education, looking at teachers' competencies in the schools of the northern region of India. The research uses a mixed-method design featuring tools, interviews, and focus group discussions to assess digital competence with its contextual nuances. This work focuses on the transformative effect of digital initiatives in education, highlighting availability, cooperation, and correctness. It is in line with the Samagra Shiksha initiative and the National Education Policy 2020, which insists on ICT integration. Notably, there are challenges like digital literacy and a lack of equal access to technology. This study highlights the grasping of digital competence is important for proper budgeting, teachers' professional development as well as changes in school organizations.

Keywords: Online Resources, Digital Competence, Schools of North India, Educational Transformation.

INTRODUCTION

The COVID-19 pandemic of the 21st century, as it has been noted, has brought about a significant shift towards technology and scientific growth (Virgili, 2021). Disturbance of global education led to the reassessment of the structure of the courses and the general way of the course delivery systems at all levels towards online educational environment (Ministry of Education, 2021). Within the framework of the NEP-2020, the Samagra Shiksha programme emphasizes the need for ICT in order to enhance education quality (Samagra Shiksha). Integration of ICTs into education improves it by expanding content availability, enabling interactivity and enhancing teaching (Aslan & Zhu, 2016; Tondeur et al., 2017). Among the educators, teachers' digital competencies are very important in as far as the effective integration of technology is concerned (Tondeur et al., 2017). In Tondeur et al. (2017), they provide that technology integration needs to comprehend digital literacy, competence, and ICT skills. According to Ferrari and Punie (2013), 'digital competence' is the use of ICT confidently, critically, and creatively. The teaching of ICT, on the other hand, also requires that teachers of ICT can use the relevant digital skills as well as needed teaching skills specific to effective teaching of ICT (Tammaro & D'Alessio, 2016; Tondeur et al., 2017). Generally speaking, in the contemporary era, when there is widespread use of technology tools, global fit, and digital competencies are very relevant in practice (Ferrari & Punie, 2013).

1. Background of the Study

In education, the prominence of the internet and digital tools has greatly affected the structure of the teaching and learning process, introducing educators and learners to various tools, platforms, and materials that are available online or on digital devices (ISTE, 2017; Mertler, 2024). Such resources transform how information is

distributed, where information is located and how it is used by providing multiple benefits that are unfathomable (Buchanan, 1998; Milligan, 2022; Peters, 2010; Selwyn, 2021). Most importantly, they offer greater affordance, that is, the capacity to be learned or acquired from any physical or time setting as long as there is an internet connection (Arafin, 2016; Haryani & Hamidah, 2022; Internet Society, 2016; Sarker et al., 2019; Singh et al., 2005). They also enhance the content by incorporating interactive aspects of it, making learning active and engaging (Finn et al., 2006). In addition, they allow and enable joint effort and interaction despite the distance between the collaborators (Naik et al., 2020). The initiatives support the National Educational Policy (NEP) 2020 and its call for the use of Information Communication Technology (ICT) in education, especially in the Samagra Shiksha initiatives in schools across India. In these states and union territories, a survey of ten schools was conducted to assess the competencies of the teachers in the use of the online digital resources. The study used a mixed design consisting of tools' development, interviews and questions, focus group discussions, and took up the digital era.

2. Literature Review

2.1 Infrastructure for ICT

Information Technology has a great impact on the educational process (Buchanan, 1998; Milligan, 2022; Peters, 2010; Selwyn, 2021). Even the Indian government acknowledges that the use of computers makes education more efficient (Arafin, 2016; Finn et al., 2006; Haryani & Hamidah, 2022; Internet Society, 2016; Sharma et al., 2022; Sarker et al., 2019; Singh et al., 2005). In places such as Karnataka and Uttar Pradesh, initiatives have begun which are focused on providing students with more digital devices (Naik et al., 2020). On that note, with the increasing urbanization, it has been postulated that technology has the potential to greatly improve both educational resources and policy. However, with significant parts of the remaining population still primarily residing in rural areas, this claim needs to be substantiated with the understanding of technology's impact on rural students. The urban-rural divide issues cannot be overemphasized without such policy intervention in the form of ICT development (Singh, 2012; Zhao et al., 2024). Robust workstations, high-speed networks, and interactive devices will be critical in addressing these requirements

2.2 Need for the Study

The Samagra Shiksha programme emphasizes the importance of ICT and other digital initiatives in improving the quality of education. Through ICT utilization, the traditional dominance of the teacher is displaced with the emphasis on the learner doing more; in other words, it increases engagement and dynamism (Ferrari & Punie, 2013; Tondeur et al., 2017). This programme requires some ICT facilities in government schools and Teacher Education Institutions (SCERTs, DIETs, and BITEs) such as computers, internet, multimedia, and software. The use of ICT in education provides access to a larger variety of resources, interactive materials, and teaching strategies such as multimedia and simulation presentations, and virtual laboratories that can improve the process (Arafin, 2016; Singh et al., 2005). It enables students to work collaboratively, think critically, learn in a customized manner and network across the globe thus heralding the era of digital-based teaching (Haryani & Hamidah, 2022; Naik et al., 2020). The current research aims to understand how in-service teachers of different schools utilize open digital resources, encouraging the improvement of digital pedagogy and effective digital assessment tool application, hence their attitude towards digital technologies. This literature review focuses on the integration of digital resources within the schools of northern Indian context with a focus on access, availability, and usage of these resources.

3. Objectives of the Study

The study examined the availability and accessibility of digital resources in schools across the state and union territories of the Northern region. It examined the provision of these resources in the school for teachers on the competencies. The study also understood the level of utilization of these digital resources by the teachers. The main objectives of the study were as follows.

- To assess the access and availability of digital resources within schools in the Northern region of India.
- To investigate the accessibility of digital resources provided to teachers in these schools.
- To determine the present utilization of digital resources and the level of ICT competencies present among the teachers.

4. Research Questions

- What digital resources are available within schools located in the Northern region of India?
- What is the status of accessibility of available digital resources provided to teachers in these schools?
- How does the utilization of digital resources impact the development of competencies among teachers?

5. Methodology

5.1 Design of the Study

The study employed a mixed-methods approach, integrating qualitative and quantitative methods to examine the availability and accessibility of digital resources in schools. A sample of 10 schools from each state and Union Territory of the northern region of India was selected, comprising 87 secondary schools in total. A total of 717 teachers of secondary schools, comprising Science, Mathematics, and Social subjects, were chosen for data collection. The schools were identified in consultation with concerned state officials of the state/UT offices. Assistance from state authorities, who appointed nodal officers to oversee the process, was also taken. Questionnaires were administered to principals and teachers to gather data on resource availability, accessibility, and utilization. Interviews with principals and teachers provided deeper qualitative insights into digital resource perspectives and experiences. The data from students has been taken up under focus group discussion and personal interviews.

5.2 Procedure of the Study

To assess the accessibility, availability, and utilization of digital resources and resulting competencies present among the teachers in schools, a team, including Study coordinators, faculty members, JPF, visited 87 secondary schools in the Northern region of India by a strategically planned tour map with taking constraints of time. They utilized questionnaires to gather data on schools' digital resource availability, access, and utilization, along with competencies developed. A tool was also developed to collect information from principals about ICT mentors and resource usage. Subsequent teacher interviews provided deeper insights into digital resource effectiveness in classroom instruction and competency development. The data were also collected from the students to augment the collected data (Tiede & Grafe, 2020).

5.3 Tools used in the Study

The present study used tools which is developed and validated expert-designed questionnaires to assess availability, accessibility, utilization of digital resources, and competencies among different subject teachers in schools. In the questionnaires, combination of closed and open-ended questions was customized based on the objectives of the study.

The following questionnaires were utilized in this study:

- *Questionnaire for Principal:* The questionnaire gathered school information on digital resource availability, accessibility, and utilization by teachers. It focused on ICT infrastructure, ICT mentor presence, ICT training of teachers, Management Information System, and internet connectivity.
- *Questionnaire for Teachers:* This survey gathers teachers' insights on digital access, ICT use, resource integration, networking, ethical ICT practices, and using technology for inclusive teaching and learning, focusing on the acquisition, organization, and creation of digital resources.

6. Results and Discussion

6.1 Availability

In the present education system, access to digital resources is crucial and enhancing teaching efficiency and creativity (Hilton, 2016). These tools facilitate and allow for lessons' instructiveness and cater to diverse learning styles, boosting student engagement and achievement (Li

et al., 2025; OECD, 2015). Many schools are equipped with various digital devices, indicating readiness for remote learning.

Table 1 presents data concerning the prevalence of various digital devices in educational institutions across different States and Union Territories (UTs) in India. The enumerated devices include desktop computers, laptops, tablets, LCD/LED displays, smart TVs, printers, scanners, external webcams, UPS systems, projectors, headphones, speakers, N-computers, and additional items.

The findings reveal that Haryana distinguishes itself with a substantial quantity of laptops (605) and tablets (1338), demonstrating a robust adoption of digital technology in educational institutions (Misra & Panigrahi, 2023; Sarker et al., 2019; Singh & Joshi, 2019). In contrast, Himachal Pradesh, Jammu & Kashmir, and Ladakh exhibit a deficiency in device availability, indicating an urgent requirement for improved digital infrastructure. Enhancing the availability of laptops, tablets, and cameras through augmented financial support and resource allocation could significantly elevate these locations. The vast resources provided by SSA/RMSA initiatives indicate that instructors possess numerous instruments to enhance classroom interactions.

Table 2 illustrates the distribution of varied digital gadgets among states and union territories. Punjab, with 17 charging stations, is in the lead, followed closely by Delhi and Rajasthan. Delhi leads with three units in satellite interactive terminals (SIT) and also excels alongside Punjab in generator/solar bundles. Uttar Pradesh leads with the most number of online UPS systems, while Delhi and Chandigarh excel in video camera prevalence. These tools augment contemporary education, rendering courses more engaging, facilitating digital learning, and enhancing connectivity among educators, students, and administrative personnel for improved coordination, equipping youngsters for the digital era.

S. N.	State/UT	Chandigarh	Delhi	Haryana	Himachal Pradesh	J& K	Ladakh	Punjab	Rajasthan	Uttarkhand	Uttar Pradesh
		Available Digital Devices in Different state and UTS									
1.	Desktop	298	245	276	172	93	78	55	93	87	45
2.	Laptop	5	86	21	0	3	6	5	6	2	1
3.	Tablet	46	605	1338	0	0	181	54	84	197	0
4.	LCD/LED Display panel/ Smart TV	34	15	115	19	6	5	12	28	11	11
5.	Printer	72	35	121	28	8	20	17	21	17	12
6.	Scanner	47	25	6	17	1	2	1	3	6	6
7.	External Web Camera	8	217	4	8	4	13	3	7	9	1
8.	UPS	124	39	118	78	6	9	7	15	57	42
9.	Projector	27	31	7	40	8	8	53	12	8	20
10.	Headphones	51	4	83	9	1	6	168	17	3	1
11.	Speakers	74	34	3	40	9	5	51	9	16	9
12.	Network-computer	1	37	10	24	0	0	137	80	1	0
13.	Smart boards	116	15	64	32	5	7	1	9	1	5
14.	Integrated Computer Projector	30	21	6	10	5	2	17	3	2	8

Table 1. Availability of Digital Devices in Schools

S. N.	State/UT	Chandigarh	Delhi	Haryana	Himachal Pradesh	J& K	Ladakh	Punjab	Rajasthan	Uttarkhand	Uttar Pradesh
		Additional Available Digital Devices									
1.	Dharging Racks	3	8	1	1	2	1	17	5	1	3
2.	Satellite Interactive Terminal (SIT)	0	3	1	0	0	0	3	2	2	0
3.	Generator/Solar Package	8	10	4	1	4	3	5	2	5	7
4.	Online UPS	4	3	2	5	1	0	1	0	0	2
5.	Video Camera	3	6	3	2	0	3	2	3	0	1

Table 2. Status of Additional Digital Devices

6.2 Connectivity

The principal of the school was asked about the internet services provided, specifically on the speed and accessibility for both instructors and pupils during school hours. The school offers many internet alternatives, including broadband, fiber optics, wireless connections, dongles, and mobile data, to guarantee dependable connectivity. These varied internet services are available during the school day and are designated exclusively for educators' use.

6.3 Accessibility

Digital devices must be easily available for teachers since they increase their ability to effectively include technology into teaching strategies. Accessible digital tools help teachers to access instructional materials, engage in professional development, and create new lesson plans tailored for different student needs (UNESCO, 2022; 2023). This simplicity promotes inclusion at all levels of learning in the school system.

6.4 Digital Infrastructure

Each secondary school teacher participated in a survey to evaluate the availability and their access to school-provided digital equipment, including desktop computers, laptops, tablets, smart boards, smartphones, and integrated computer projectors. A total of 87 schools of 10 states and UTs of the Northern region comprising 247 Social Sciences teachers, 274 Science and Mathematics teachers, and 264 Language teachers participated in the study covered as shown in Table 3.

The principal of the school confirmed the availability of the laptops as well as PCs in the computer inventory. The teachers reiterated the availability of computing equipment at the school, which strengthened this information. Distinct student demographics and topic areas indicate the variations in the number of involved professors among different institutions. From all disciplines, most teachers said they had access to either a desktop or a laptop for their classroom needs. The way the data is interpreted reveals varied degrees of digital device access among union territory and state instructors. With availability varying from 19% in Haryana to 78% in Chandigarh, desks were the most often found gadget. Laptops were also rather common, especially in Delhi and Chandigarh, where more than 30% of teachers had access to them. Tablets, smart boards, smart phones, and integrated projectors had more diverse availability depending on the state; some states had especially low access rates. The statistics show differences in access to digital tools among teachers in different states, implying a need for fair distribution to assist successful teaching and learning all around. The availability of digital tools helps teachers to use technology for educational reasons, therefore improving teaching efficacy and student involvement in many different disciplines. The access to various devices is shown in Figure 1

6.5 Utilization

The study explored for the way that how subject teachers utilise digital resources to enhance their methods of teaching and enhance the achievement of learners (Bullen & Morgan, 2015). The study explores how well ICT tools and electronic educational materials are used, therefore clarifying the interaction of technology with

State/UTt	No. of Schools Visited	No. of teachers participated	Access to digital devices provided in the school					
			Desktop	Laptop	Tablet	Smart board	Smartphone	Integrated Computer Projector
Chandigarh	10	100	78	13	14	71	25	57
Delhi	10	87	30	23	77	30	28	36
Haryana	9	84	19	4	55	42	22	9
Himachal Pradesh	10	94	61	8	4	51	20	40
Jammu	4	38	21	10	4	18	13	16
Ladakh	10	52	22	23	15	10	28	08
Punjab	6	47	30	5	5	14	18	37
Rajasthan	9	71	28	13	3	8	17	16
Uttarkhand	9	66	21	7	4	14	18	10
Uttar Pradesh	10	92	21	3	4	28	30	18

Table 3. Status of Access of Digital Devices in the Schools

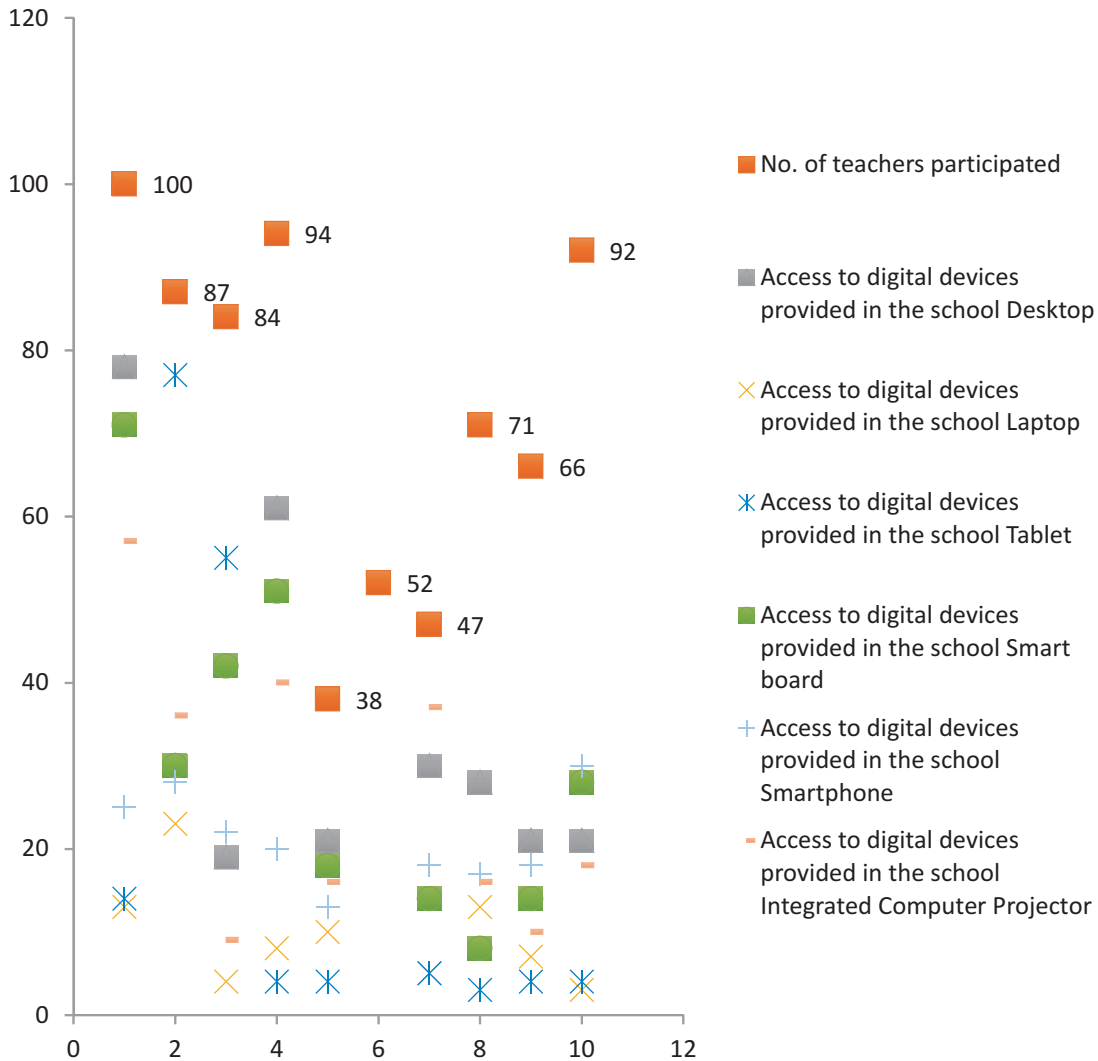

Figure 1. Status of Access to Different Devices

education. It's all about finding the magic those results from teachers embracing the digital sphere to enhance their students' By providing immediate access to material that encourages group projects, digital resources, ICT tools, and software applications tremendously enhance education. These tools enable pupils to study in several ways and increase the interesting nature of their education. The use of these instruments requires varying levels of competence. Fundamentally, basic skills involve how to use computers and search the internet. Among intermediate skills are designing presentations and applying several programs. Advanced talents call for complicated data work and programming. The development of these abilities helps kids to be prepared for the technologically advanced future.

Table 4 shows varied level capabilities among teachers using the ICT tools in different phases of learning during classroom process.

Assessing how different subject teachers use ICT devices points out both areas of strength and areas needing work. A noteworthy positive is that a good basis for future improvement in abilities is shown by the substantial proportion of teachers in Social Sciences (51.82%) and Languages (56.06%), who show basic proficiency in using computers. Furthermore, language teachers shine in word processing—79.24% at the basic level suggests numerous opportunities for successful documentation and communication.

Nevertheless, one must additionally take into account

ICT devices and use by different subject teachers	Level of Competence			
	None	Basic	Intermediate	Advanced
Handling Computer				
Social Sciences	21.1(52)	51.82(128)	18.6(46)	8.5(21)
Science and Mathematics	13.9(38)	47.08(129)	24.08(66)	15.3(42)
Languages	21.96(58)	56.06(148)	17.42(46)	4.92(13)
Word processing				
Social Sciences	30.4(75)	43.72(108)	15.8(39)	10.1(25)
Science and Mathematics	19.34(53)	40.87(112)	21.16(53)	15.3(42)
Languages	29.92(79)	79.24(130)	14(37)	7.2(19)
Presentation and multimedia application				
Social Sciences	32(79)	38.05(94)	18.6(46)	10.9(27)
Science and Mathematics	26.64(73)	36.86(101)	22.62(62)	15.3(42)
Languages	32.57(86)	40.9(108)	21.96(58)	4.55(12)
Internet use				
Social Sciences	16.6(41)	42.51(105)	23.1(57)	17.8(44)
Science and Mathematics	10.2(28)	38.32(105)	26.27(72)	23.72(65)
Languages	14.4(38)	43.93(116)	26.51(70)	12.1(32)
Web Search and use of search engines				
Social Sciences	27.5(68)	34.82(86)	21.5(53)	16.2(40)
Science and Mathematics	19.70(54)	34.67(95)	22.26(61)	23.35(64)
Languages	27.65(73)	38.25(101)	20.83(55)	13.6(36)
Downloading and uploading of files				
Social Sciences	23.9(59)	42.91(106)	19(47)	15(37)
Science and Mathematics	16.1(44)	39.41(108)	27(74)	18.97(52)
Languages	21.59(57)	43.93(116)	32.57(86)	12.1(32)
Creating and converting files				
Social Sciences	38.46(95)	35.22(87)	15.4(38)	12.1(30)
Science and Mathematics	25.54(70)	41.97(115)	14.2(39)	16.4(45)
Languages	37.5(99)	42.42(112)	15.2(40)	6.44(17)
E-mail				
Social Sciences	20.6(51)	44.12(109)	20.6(51)	14.6(36)
Science and Mathematics	13.9(38)	40.87(112)	25.18(69)	19.70(54)
Languages	18.18(48)	45.45(120)	20.45(54)	12.1(32)
Downloading and installing programmes				
Social Sciences	28.3(70)	38.46(95)	21.5(53)	11.3(28)
Science and Mathematics	19.70(54)	43.06(118)	20.07(55)	16.1(44)
Languages	32.57(86)	42.42(112)	18.18(48)	7.2(19)
Online presentation (Video conferencing, online meeting etc. and discussion				
Social Sciences	21.5(53)	42.51(105)	22.7(56)	13(32)
Science and Mathematics	15.3(42)	44.52(122)	20.8(57)	18.61(51)
Languages	22.34(59)	48.48(128)	18.93(50)	10.6(28)
Social media, online chats and instant messaging				
Social Sciences	15.4(38)	38.46(95)	25.9(64)	16.2(40)
Science and Mathematics	12.4(34)	35.03(96)	30.29(83)	17.88(49)
Languages	15.5(41)	50(132)	20.45(54)	14.4(38)
Accessing and using digital resources				
Social Sciences	21.5(53)	41.70(103)	25.9(64)	10.9(27)
Science and Mathematics	15.3(42)	44.52(122)	22.62(62)	16.8(46)
Languages	21.21(56)	48.48(128)	22.34(59)	7.95(21)

Table 4. Level of ICT Competencies of Teachers Teaching Selected School Subjects

certain undesirable features. Particularly in languages where just 4.92% show advanced skills, advanced competencies in using computers remain low across all disciplines. Regarding presentation and multimedia technologies, although basic knowledge is clear (32% in Social Sciences and 32.57% in Languages), the advanced levels are low, with only 10.9% and 4.55%, respectively, thereby showing a gap in using these resources for effective instruction.

While Science and Mathematics lead in intermediate skills (26.27%), demonstrating that some teachers are more skilled at using online resources than others, Internet

usage displays a mixed picture with Social Sciences (42.51%) and Languages (43.93%) teachers reporting strong basic competency. Particularly in downloading and uploading, file management abilities are rather strong across disciplines, especially in Languages (43.93% basic competence).

On the down side, especially in the Social Sciences where 38.46% of respondents say they lack competence, the ability to create and transform files is less evolved. Although instructors have a good basis of fundamental skills, the low advanced competences draw attention to the requirement of focused training and assistance to raise their ICT proficiency and hence increase the teaching effectiveness. Table 5 presents

Use of ICT software's/applications and digital resources effectively	Level of Competence			
	None	Basic	Intermediate	Advanced
Collaborative tools e.g. Google docs, Sheets, MS office etc.				
Social Sciences	33.60(83)	39.67(98)	17.4(43)	8.91(22)
Science and Mathematics	23.35(64)	44.16(121)	21.16(58)	11.7(32)
Languages	32.95(87)	44.31(117)	18.18(48)	6.44(17)
Presentation Tools				
Social Sciences	32.4(80)	39.67(98)	18.6(46)	8.91(22)
Science and Mathematics	23.35(64)	42.70(117)	20.07(55)	13.5(37)
Languages	32.57(86)	86.59(123)	14.8(39)	7.2(19)
Educational applications e.g. e-Pathshala, Bolo, mobile Apps, Google Earth, Geo Gebra etc.				
Social Sciences	32.4(80)	44.53(110)	13.8(34)	8.91(22)
Science and Mathematics	22.26(61)	43.06(118)	22.62(62)	13.9(38)
Languages	32.19(85)	45.45(120)	18.18(48)	4.55(12)
Online Classes Tool e.g. Google Meet, teams, Zoom etc.				
Social Sciences	21.9(52)	43.72(108)	21.9(54)	13(32)
Science and Mathematics	15.7(43)	40.51(111)	25.91(71)	16.4(45)
Languages	21.21(56)	45.83(121)	20.45(54)	13.6(36)
Audio Tools e.g. Audacity, Podcast, etc.				
Social Sciences	40.08(99)	42.51(105)	11.3(28)	6.7(15)
Science and Mathematics	43.06(118)	34.3(94)	12(33)	10.6(29)
Languages	44.31(117)	39.77(105)	9.85(26)	6.44(17)
Video Tools e.g. YouTube				
Social Sciences	15.4(38)	49.39(122)	22.3(55)	13(32)
Science and Mathematics	14.6(40)	42.7(117)	25.51(71)	16.8(46)
Languages	18.93(50)	45.45(120)	22.72(60)	13.3(35)
Web 2.0 e.g. Wiki, Blog etc.				
Social Sciences	5.20(124)	28.3(70)	12.1(30)	4.45(11)
Science and Mathematics	49.63(136)	32.48(89)	10.9(30)	6.57(18)
Languages	57.95(153)	30.30(80)	9.47(25)	1.89(5)
Animation Tools e.g. Stop motion				
Social Sciences	54.25(134)	33.19(82)	8.5(21)	4.05(10)
Science and Mathematics	52.9(145)	34.30(94)	8.76(24)	6.57(18)
Languages	63.25(167)	27.27(72)	7.95(21)	2.27(6)
Virtual labs/ Simulations e.g.Olabs, PhET				
Social Sciences	60.72(150)	29.6(73)	6.7(15)	4.86(12)
Science and Mathematics	51.8(142)	30.29(83)	11.3(31)	6.57(18)
Languages	63.18(180)	24.62(65)	6.44(17)	1.14(3)
Assessment and feedback Tools e.g.kahoot, Google forms, Live worksheets				
Social Sciences	40.89(101)	40.48(100)	11.7(29)	7.29(18)
Science and Mathematics	31.38(86)	41.97(115)	16.8(46)	9.85(27)
Languages	43.56(115)	40.53(107)	13.3(35)	3.41(9)
Online Course tools e.g. SWAYAM Coursera, Udemy etc.				
Social Sciences	39.67(98)	43.31(107)	9.72(24)	7.69(19)
Science and Mathematics	40.14(110)	41.24(113)	11.3(31)	8.3(22)
Languages	45.45(120)	40.90(108)	10.2(27)	3.79(10)
Cloud Storage (One Drive, Google Drive)				
Social Sciences	39.27(97)	40.48(100)	13(32)	6.48(16)
Science and Mathematics	37.95(104)	42.33(116)	11.3(31)	8.39(23)
Languages	43.56(115)	42.80(113)	9.47(25)	4.55(12)

Table 5. Assessment of Teachers on ICT Proficiency and Software Utilization

the Assessment of Teachers on ICT Proficiency and Software Utilization.

Figure 2 illustrates the differing levels of competence in collaborative tools among the disciplines of Social Sciences, Science and Mathematics, and Languages. The Social Sciences exhibit a basic competence level of 39.67%. In contrast, the Science and Mathematics domains show a basic competence of 44.16% and an advanced competence of 11.7%. The Languages category reflects a significant, balanced level of familiarity with various tools. Customised training is needed, particularly in the subjects of Social Sciences and Languages, to enhance and improve the utilisation of digital tools in educational environments.

7. Presentation Tools

Figure 3 provides an analysis of competency levels in the utilisation of presentation tools such as PowerPoint and Keynote across three academic domains: Social Sciences, Science and Mathematics, and Languages.

For Social Sciences, the data reveals that 39.67% of teachers possess basic competence, which is slightly lower than the 42.70% of Science and Mathematics teachers who have basic competence, with 13.5% classified as advanced. The Language teachers demonstrate a high proficiency in basic skills, achieving a score of 86.59%. However, this also shows that necessity is required to improve the desired competencies in various aspects related to presentation tools. The possibility for skill development reflects that for both intermediate and advanced levels. Utilising the strengths of languages can enhance the overall proficiency in presentation tools.

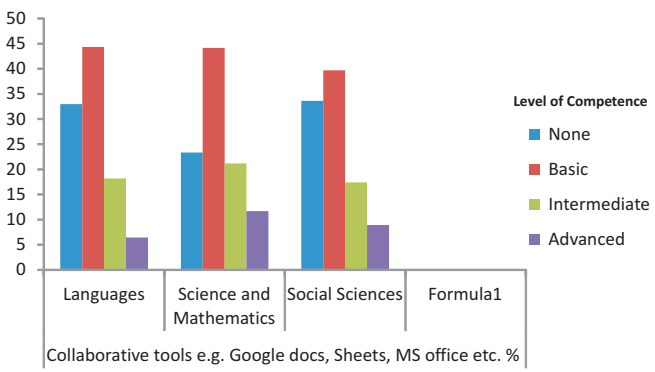

Figure 2. Usage and Adoption of Collaborative Tools

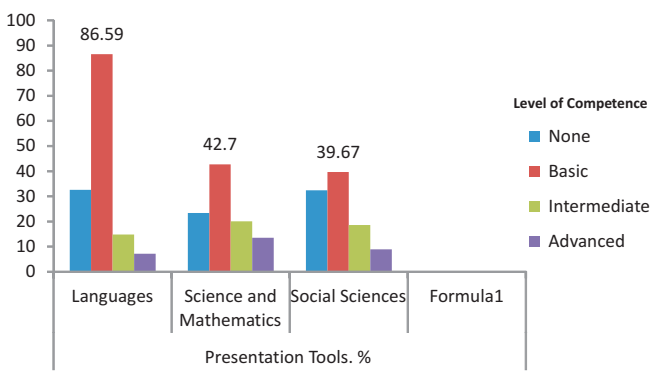

Figure 3. Use of Presentation Tools in the Workplace

8. Educational applications, e.g., e-Pathshala, Bolo, mobile Apps, Google Earth, Geo Gebra, etc

Figure 4 illustrates the various degrees of competence in various digital educational applications within the domains of Social Sciences, Science and Mathematics, and Languages (Gond & Gupta, 2017). Science and Mathematics exhibit an intermediate level of proficiency (43.06% to 45.45%) in making use of online tools. These data indicate that the groups of teachers are highly motivated but still need adequate input to enhance the Competence levels in the Social Sciences range from 32.4% to 44.53%. Proficiency in languages remains insufficient, suggesting a necessity for improvements. The data indicates that basic inputs are necessary for these tools.

9. Online Classes Tool, e.g., Google Meet, Teams, Zoom, etc

Figure 5 shows proficiency in educational applications across Social Sciences, Science, and Mathematics, and

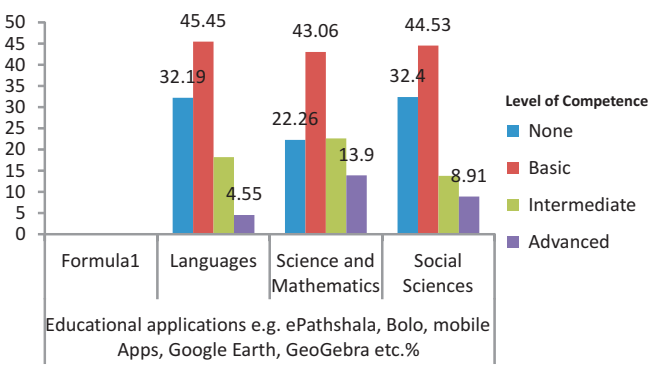

Figure 4. Use of Educational Applications

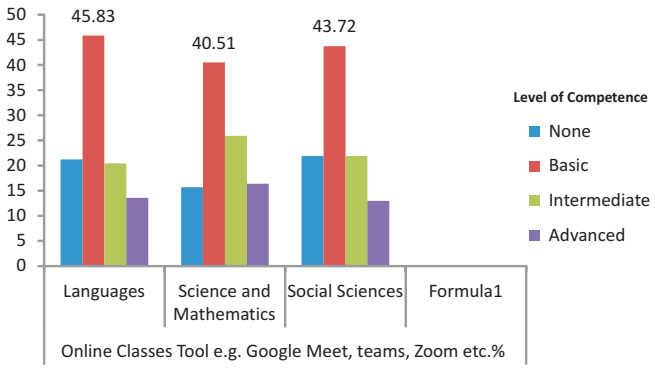

Figure 5. Use of Online Classes Tool e.g. Google Meet, teams, Zoom etc

Languages. Science and Mathematics demonstrate intermediate competence (43.06% to 45.45%) in the use of online tools. Social Sciences show varying competence levels (32.4% to 44.53%). Languages have lower proficiency, highlighting the need for improvement. The data reflects that essential inputs are required for such tools.

It underscores the significance of online educational technologies such as Google Meet, Teams, and Zoom in academic instruction, particularly in Social Sciences, Science and Mathematics, and Languages. Science and Mathematics demonstrate superior proficiency (40.51% to 45.83%), Social Sciences exhibit moderate performance (21.9% to 43.72%), while Languages show a deficiency, highlighting the necessity for enhancement of online educational tools, particularly in Languages, to improve remote learning experiences and effectiveness in fostering a high level of competence.

10. Audio Tools e.g. Audacity, Podcast, etc

Figure 6 illustrates that Science and Mathematics have 43.06% at the intermediate level and 10.6% at the advanced level. Although these percentages are lower, they significantly indicate that educators in these disciplines are driven, and minimal input could elevate their competence levels. Languages demonstrate a 44.31% proficiency at the intermediate level, and just 6.44% at the advanced level, indicating subpar performance. Social Sciences comprise 42.51% at the basic level and 6.7% at the advanced level. All domains exhibit a robust association between intermediate and advanced levels of

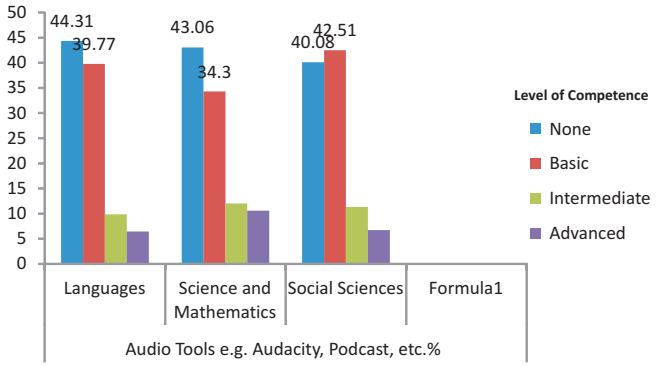

Figure 6. Use of Audio Tools, e.g., Audacity, Podcast, etc

audio tool usage (green), although a modest correlation between none and basic levels (red), signifying the necessity to enhance basic competence across all domains while simultaneously advancing intermediate.

11. Video Tools, e.g., YouTube

The data highlighted in Figure 7 indicates the significance of video tools, notably YouTube, within educational contexts encompassing Social Sciences, Science and Mathematics, and Languages.

Teachers across Social Sciences, Science and Mathematics, and Languages exhibit strong proficiency in using video tools, with a significant percentage at intermediate and advanced levels. This indicates that video tools can greatly enhance learning outcomes and experiences in many domains of the school subjects.

12. Web 2.0, e.g., Wiki, Blog, etc

The data reveals significant information about the use and proficiency levels of Web 2.0 tools, such as wikis and blogs, across the Social Sciences, Science and Mathematics, and Languages subjects. Improving the successful integration

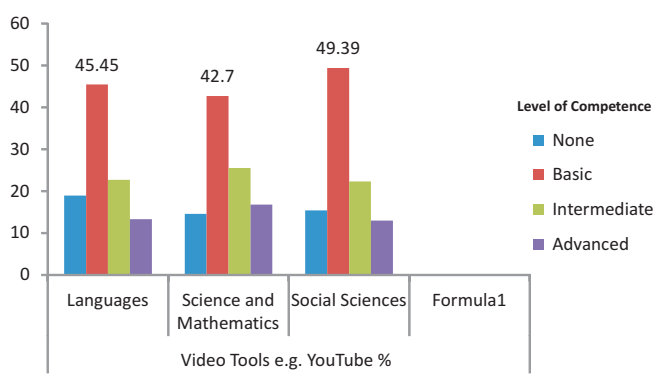

Figure 7. Use of Video Tools, e.g., YouTube

of these technologies is necessary, as 28.3% of teachers of social science show basic competence and 5.20% show a lack of expertise. While Science and mathematics subject teachers show 49.63% basic competence. 10.9% show a lack of knowledge that could make tool use difficult. Although 57.95% of language teachers have a basic understanding, 1.89% need specialised training to effectively use Web 2.0 resources.

13. Animation Tools, e.g., Stop Motion

Figure 8 shows use of Animation tools.

13.1 Social Sciences Teachers

The data given in the graph indicates that proficiency levels in Social Sciences demonstrate that a significant percentage (54.25%) of teachers possess intermediate competence in using animation tools. However, a relatively lower percentage (4.05%) shows advanced proficiency. This suggests that while a substantial number of Social Sciences teachers have a basic understanding, there is room for improvement in reaching advanced proficiency levels.

13.2 Science and Mathematics Teachers

The fact that a lot of people (52.9%) have basic skills in both science and math shows that animation tools could be used to help with integration. Also, 6.57% of the population shows intermediate proficiency, which shows that more and more complex methods are being used. Nonetheless, to make sure that animation tools are used most effectively for teaching purposes, it is necessary to put in a lot of work to improve skill levels.

13.3 Languages Teachers

It's interesting to note that language teachers are very good at using animated tools; in fact, 63.25 percent of them show that they are intermediately skilled. The advanced proficiency level, which makes up only 2.27 percent of the whole, is not very high, which means that growth can still be made. Improving language teachers' skills in using animation tools could make learning languages a lot more fun and useful.

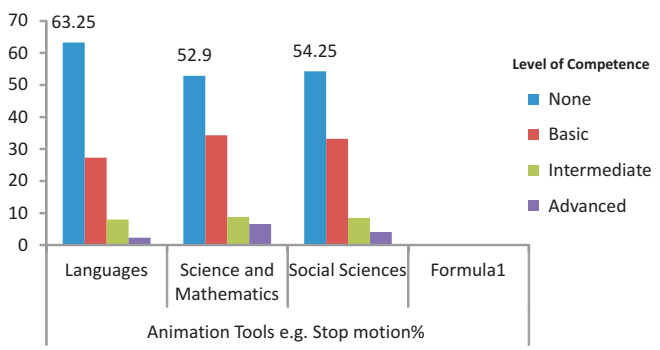

Figure 8. Animation Tools, e.g., stop motion

14. Virtual labs/ Simulations e.g.Olabs, PhET

Figure 9 presents competence levels of using virtual labs and simulations (e.g., Olabs, PhET) among teachers in different academic domains: Social Sciences, Science and Mathematics, and Languages.

A majority of Social Sciences teachers (60.72%) display intermediate proficiency in utilizing virtual labs and simulations, indicating a strong foundational understanding.

Only a few (4.86%) demonstrate advanced competence, showing space for skill improvement and integration. In Science and Mathematics, 51.8% of teachers have intermediate skill with virtual labs and simulations, while advanced proficiency shown by only 6.57% of teachers. This advanced competency may improve educational resource use. Most language teachers (63.18%) have intermediate virtual lab and simulation skills. However, the advanced competency level is low (1.14%), highlighting the need for more training to fully utilise these tools in language teachers.

15. Assessment and Feedback Tools, e.g., Kahoot, Google Forms, Live Worksheets

The data presented in Figure 10 indicates the proficiency levels of teachers from different subject areas in using

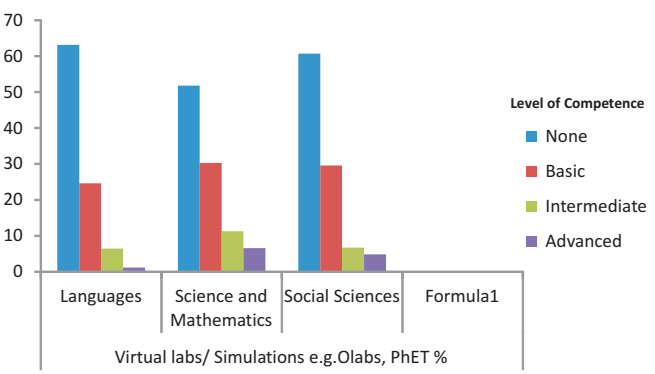

Figure 9. Virtual labs/ Simulations, e.g., Olabs, PhET

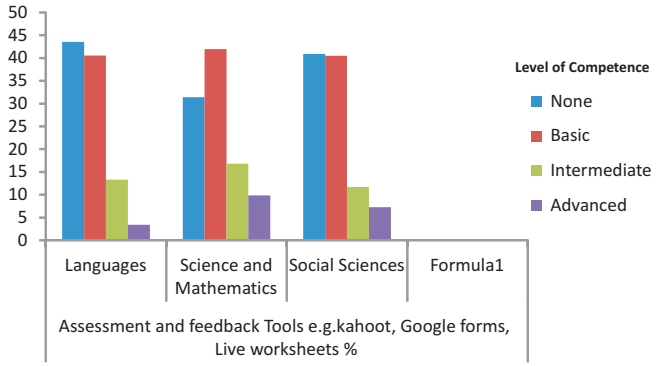

Figure 10. Assessment and Feedback Tools

assessment and feedback tools such as Kahoot, Google Forms, and Live Worksheets. It also hints at areas where teachers show relatively lower performance and the potential consequences of such lower performance.

The level of competence in utilizing evaluation and feedback technologies among Social Sciences teachers indicates moderate proficiency, with 40.89% at the basic level and 40.48% at the intermediate level. However, a relatively small minority (11.7%) demonstrates a high level of proficiency, which is a positive indication. The reduction in advanced proficiency may result in less engaging assessment methods, thereby limiting the depth and effectiveness of feedback provided to students. In Science and Mathematics, a significant level of skill is observed, with 41.97% at the intermediate level and 31.38% at the basic level in the application of evaluation and feedback methods. The advanced proficiency stands at 16.8%, indicating potential for improvement and demonstrating the capabilities of teachers. This lower advanced competency may involve less comprehensive assessments, thereby hindering a complete evaluation of students' understanding and reducing the quality of feedback among teachers.

A noteworthy percentage of Language teachers (43.56%) display intermediate skills, while 40.53% exist at a basic level in the utilization of assessment and feedback systems. The percentage of individuals demonstrating advanced proficiency is relatively low at 3.41%. The decline in advanced proficiency may result in less tailored and effective feedback, thereby affecting students' learning outcomes and language development.

16. Online Course tools e.g. SWAYAM Coursera, Udemy etc

Data from platforms like SWAYAM, Coursera, and Udemy is invaluable for understanding user engagement and preferences, allowing for customized course offerings and improved learning experiences. It also aids in assessing course effectiveness for continuous improvement. Figure 11 shows insights from subject teachers regarding utilizing online course tools.

In Social Sciences, only 7.69% show advanced skills while 43.31% exhibit intermediate proficiency, showing space for improvement. With 41.24% and 40.14% at intermediate and basic levels, respectively, and 8.3% at an advanced level, mathematics and science teachers show similar trends. Teachers teaching languages 45.45% display intermediate proficiency; just 3.79% show advanced competency, suggesting a need to improve advanced skills for the best use of online course platforms in language instruction.

17. Cloud Storage (OneDrive, Google Drive)

Figure 12 shows Cloud storage usage. With 40.48% at

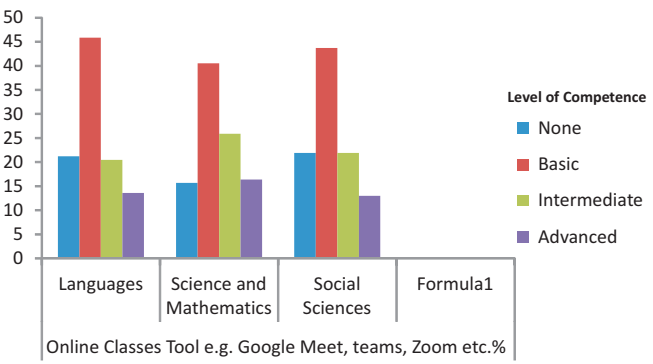

Figure 11. Online Course tools, e.g., SWAYAM, Coursera, Udemy, etc

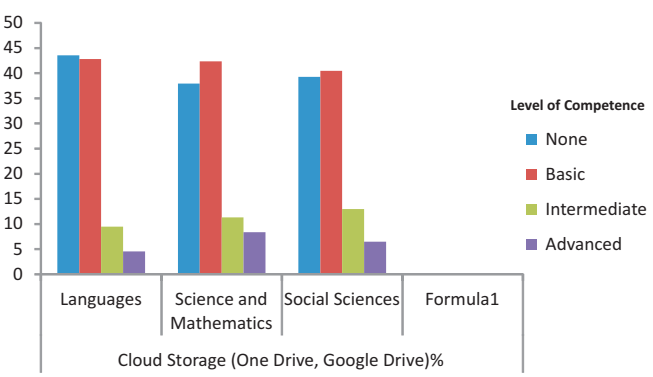

Figure 12. Cloud Storage (One Drive, Google Drive)

the intermediate level and 39.27% at the basic level, Social Science teachers show modest competence in cloud storage use; just 6.48% at an advanced level, therefore stressing the need for improved advanced abilities. Teachers of Science and Mathematics also show a similar trend: 42.33% at intermediate and basic levels, respectively, and 8.39% at an advanced level. Although most (43.56%) of language teachers show intermediate competence, they lag in advanced proficiency at 4.55%, showing the importance of tools. Assessing ICT integration in education, guiding customised strategies, resource allocation, and successful teacher training for better educational results depends on such information.

Table 6 reveal the extent to which ICT is integrated into the teaching-learning process and assessment/evaluation, segmented by different subject teachers. The data from various subject areas in the Northern region highlights the varied levels of ICT integration among teachers. In Social Sciences, while there is a fair basic competence (51.82%) in ICT, there's room for growth toward intermediate and advanced levels to make teaching more impactful. Science and Mathematics teachers demonstrate a relatively higher proficiency, with a substantial proportion at the intermediate level (47.4% to 25.18%), indicating effective ICT integration that aids teaching and assessment processes. Similarly, Language teachers exhibit a remarkable level of basic to intermediate competence (53.03% to 19.31%), showcasing potential for enhancing immersive learning experiences through further ICT integration in language teaching. These findings reflect the importance of continuous professional development programmes for teachers and targeted training to bridge competence gaps and elevate overall digital proficiency, ultimately enhancing the teaching, engagement, and evaluation methods across subjects.

Conclusion

Based on research conducted in selected schools in North India, teachers' knowledge of information and communication technology differed from subject to subject. Even though a good number of teachers demonstrated basic to intermediate skills in word processing, emailing, and presenting through PowerPoint, they do not possess sophisticated skills in multimedia applications and internet presentations. Proficiency in ICT is often higher among a few teachers of all the subject areas. There is a need to design targeted, continuous professional development courses based on skills of ICT to fill these gaps and stimulate more inventive teaching methods. At the same time, these programmes make sure that digital aids are effectively employed for teaching and learning purposes in various fields.

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Integration of ICT into Teaching Learning and Evaluation	Level of Competence			
	None	Basic	Intermediate	Advanced
Extent to integrate ICT in teaching –learning process				
Social Sciences	24.3(60)	51.82(128)	16.2(40)	7.69(19)
Science and Mathematics	19.7(54)	47.4(130)	25.18(69)	7.66(21)
Languages	25(66)	53.03(140)	19.31(51)	3.03(8)
Extent to integrate ICT in assessment and evaluation				
Social Sciences	3.24(8)	48.17(119)	10.9(27)	7.29(18)
Science and Mathematics	24.81(68)	46.71(128)	22.26(61)	6.57(18)
Languages	31.81(84)	46.96(124)	17.80(47)	3.41(9)

Table 6 ICT Integration in Teaching, Learning, and Evaluation by Competence Level

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