

# Professional Development and Digital Literacy: Addressing Technological Challenges among Secondary School Teachers with Special Reference to Patna District

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**Abstract - Digital literacy is a recent competence that has taken up a vital role in contemporary education especially to the teachers who are a key factor in incorporating technology in teaching learning process. Teachers in most developing areas, however, still struggle with technology in terms of insufficient training and digital resources. The research question of the current study is the following: How do professional development and access to digital tools contribute to the effectiveness of teaching and digital literacy among teachers in Patna district secondary schools? In particular, the study investigates how professional development and teaching effectiveness are related and how ICT training and access to digital resources affect the digital literacy of teachers. Mixed-method research design was used based on a structured questionnaire that was used on 148 teachers in secondary schools who were sampled by adopting stratified random sampling. The analysis of the data was conducted with the help of the descriptive statistics, correlation, and regression methods with the assistance of the SPSS 27. It can be found that there is a significant positive correlation between professional development and teaching effectiveness ( $r = 0.321$ ,  $p < 0.05$ ) and that access to digital resources and ICT training is a significant predictor of digital literacy in teaching. The study finds that sustained professional learning and enhanced technology infrastructure are essential to enhancing the digital skills of the teachers. But the study is restricted to one district and a rather small sample. Further researchers in the future should cover the wider geographical situations and consider other institutional and behavioral variables that affect digital literacy in education.**

**Keywords: Digital literacy, Professional development, ICT training, Teaching effectiveness, Secondary school teachers**

## I. INTRODUCTION

### 1.1. Background

Digital literacy is one of the most important issues that are becoming prominent in the world among the other literacy problems that are still being experienced in the underdeveloped regions. Digital skills are increasingly taking precedence, as the world keeps becoming more digital due to the enormous technological changes that have taken place. These advancements have yet to be made known in rural regions around the world (Kerkhoff, & Makubuya, 2022). In the modern world, digitalization is the sole means of maintaining growth and competitive advantages over the rivals in any sphere. Digitalization in the education sector has also achieved a lot within the aspect of workload reduction, data management and enhancing efficiencies. In addition, students and teachers are exposed to the impact of digitalization. It has increased the channels and access to sources of education as well as enhancing the learning and understanding process of students and teachers (Soekamto, et al., 2022).

Nevertheless, the success of this digitalization in the educational process regarding the student learning process is not only dependent on the educational institutions, but also on the teachers and their digital competencies (Oyetade, et al., 2020). To this end, there is need to train teachers in a manner that would lead them to appropriately integrate digital skills that should meet the intended level of digital literacy to improve the economic development of the society. In the contemporary world virtually all educational

organizations have adopted the use of digital tools in the education process, but rural regions remain far behind in adopting these developments (Pangrazio, et al., 2020).

A number of governments and software companies such as Microsoft have introduced a number of programs to equip teachers in the rural areas with digital literacy enabling the non-profitable population to also help the country to develop in terms of economic growth around the globe. The programs are launched at the national scale, and they normally offer free of charge training to teachers working in the rural region and offer the required digital resources to them (Soekamto, et al., 2022). Nevertheless, these technological developments in rural settings are inhibited by a number of internal and external factors. The study finds out the advantages and necessity of the professional growth of the teachers in the rural setting according to the digital literacy and bring to light the disadvantages and the constraints to the digital literacy of the rural teacher (Oyetade, et al., 2020).

### 1.2. Evolution of the digital literacy concept

The general definition of literacy involves having the capacity to read, listen, speak and write in a way that one can communicate effectively and learn the world. With time, the definition of this concept has grown beyond mere reading and writing to the capacity to understand and make sense of the information presented in other forms (Rani, 2025). As the use of technology in the daily life of individuals increases, the old concept of literacy has changed to incorporate the aspect of use of digital tools and platforms in expressing and communication. Further, social aspect of literacy focuses on participatory and collaborative interactions as opposed to individual performance (Malotiya, et al., 2023).

With technology ever-evolving the society in the twenty first century, the digital competence has become an obligation and a right of the citizens to operate efficiently (Soufghalem, 2024). Digital literacy was coined by Paul Gilster in the year 1997 in his book the digital literacy which he referred to as the capacity to comprehend and utilize the information contained in different sources of digital media. Subsequently, Lahiri, et al. (2024) defined digital literacy as a survival skill, which entails problem-solving skills in the digital environment. UNESCO (2018) states that digital literacy

encompasses access, management, evaluation and creation of information using digital technologies in a safe way.

The study is important because it has pointed at the need of professional development and digital literacy in enabling secondary school teachers to efficiently incorporate technology into the teaching-learning process. With the fast-changing digital age, a majority of educators are struggling with technological issues that impede the application of digital technologies in classrooms. With Patna district in mind, the study is expected to determine the current loopholes in digital proficiency and preparation of teachers. The results can help policy makers, educational administrators, and institutions develop specific training programs, eventually, leading to improvement in teaching practices, learning outcomes among the students, and the promotion of technology-based education.

## II. LITERATURE REVIEW

Sinha, S. (2025) analysed models of teacher professional development in technology-enhanced learning in Indian sector of learning. As technological adoption grows quickly following COVID-19 and NEP 2020 was already introduced, it hoped to discover how to build powerful frames on the creation of technological pedagogical knowledge in the teacher. Based on a systematic literature review and case study, the results indicated that continuous learning, collaboration, and reflective practice are main factors that can enhance the digital competence of teachers.

Soufghalem, A. (2024) investigated the role of technology in increasing digital literacy levels of secondary school students. As the role of digital skills in education is becoming increasingly significant, the purpose of the study was to assess the contribution of technology to enhancing the competencies of students. Through a mixed-methods design that incorporated both surveys and interviews, found that interactive tools enhanced information literacy, communication, and collaboration although inequalities in access and different levels of skills became the major issues to be considered.

Varghese, J., & Arya, A. K. (2024) studied the condition of digital literacy skills of 21 st century among future teachers in Kerala. It was important to note that the role of ICT and media literacy in contemporary education was acknowledged;

therefore, the purpose of the study was to examine the levels of digital literacy and demographic factors. Likert scales and questionnaires were used to collect data on 860 potential teachers, which were analyzed with the help of t-tests and ANOVA. Results indicated mediocre skills and inadequate curriculum support in the development of digital literacy.

Rawal, D. M. (2024) examined the digital divide within the Indian education system beyond the access of technology. Since NEP 2020 focused on the implementation of technology, it sought to examine the connection linking digital infrastructure and teacher training. Desk research-based and secondary data sources of UDISE revealed few changes between states and a significant correlation between infrastructure and teacher education, which means that the development should be continuous, and every student should have equal digital opportunities.

Chama, A. (2023) explored issues on how to teach digital skills in secondary school students in Zambia. As the significance of digital education increased, it attempted to analyze the attitude of teachers towards the use of technology. With a survey sample of 281 teachers in 20 Lusaka schools, the results were indicated using SPSS, the findings showed moderate skills in digital activities, but the teachers were hindered by high prices, resource scarcity, and curriculum mismatch, indicating the need to have a better policy and facilities.

Kaushal, D. V., et al., (2022) studied digital literacy programs in India, through Digital India program. Given an increasing demand in digital skills, it tried to examine the benefits and issues of digital literacy growth. The results of qualitative desk study utilizing secondary sources indicated that there are benefits like access to global knowledge and better learning, although poor infrastructure and low literacy remained a problem and required more powerful training and integrative digital policies.

Hassan, M. M., & Mirza, T. (2021) interviewed the views of teachers in the schools of Rajouri district, Jammu and Kashmir on the integration of ICT in schools. As the role of digital education is gaining significance due to globalization, it sought to establish those factors that lead to resistance of teachers to use of ICT. Through assessment-based methodology, the results indicated that low levels of digital competence hindered effective ICT

integration, and teachers should be trained and supported to enhance technology-enhanced learning, particularly in the context of the COVID-19 pandemic.

Mohalik, R. (2020) studied the degree and application of digital literacy within teacher trainees in the state of Odisha, India in secondary schools. It was interested in evaluating the use of digital technologies and their applications among trainees, which is why they started to pay increased attention to the role of digital technologies in education. Based on the findings of a descriptive survey of 170 trainees using a questionnaire, it was found that basic skills in operations were observed but only little knowledge regarding advanced tools was found and stronger ICT integration in teacher education was needed.

The current study has explored digital literacy in different dimensions, such as the professional growth of teachers, the integration of technology in education context, and digital skills that are possessed by students and teacher trainees. Studies have discussed advantages of technology in boosting digital skills, and also outlined issues of the poor infrastructure, disparity, insufficient support of curricula, and insufficient educator preparation (Sinha, 2025; Soufghalem A., 2024; Varghese J., 2024; Rawal D. M., 2024). Nevertheless, the overall impact of digital infrastructure, teacher competence, and institutional support on the build of digital literacy among potential teachers in certain regional settings is only slightly studied, which suggests that further scientific studies should be more focused.

### III. RESEARCH METHODOLOGY

The study adopted a mixed-method design, that is combining the methods of qualitative and quantitative research, and was implemented in the Patna district among teachers of secondary schools. The participants were selected on a stratified random basis and a sample of 148 people was selected. The study used a structured questionnaire to collect data and included both primary and secondary sources of information to have all-inclusive information. The study adhered to descriptive and analytical research design, and professional development (H1), access to digital resources and ICT training (H2) were the independent variables whereas teaching effectiveness (H1) and digital literacy (H2) were the dependent variables. The data were processed with the help of MS Excel and SPSS 27 where the mean,

standard deviation, correlation, and regression methods were applied to observe relationships and predictive feedback.

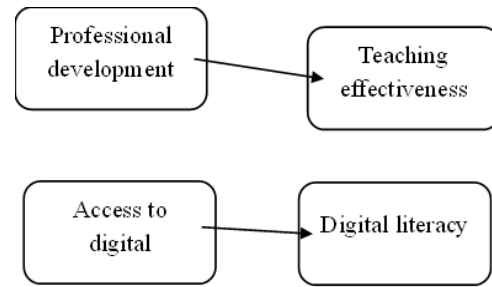


Figure 1: Conceptual model  
Source: Authors own compilation

IV. STATISTICAL ANALYSIS

Table 1: Demographic profile of the respondents

S. No	Demographic variables		N	%
1	Age	Below 30 years	32	21.6
		31-40 years	36	24.3
		41-50 years	47	31.8
		Above 50 years	33	22.3
2	Gender	Male	71	48.0
		Female	77	52.0
3	Type of school	Government	45	30.4
		Government-aided	58	39.2
		Private	45	30.4
4	Teaching experience	6-10 years	35	23.6
		11-20 years	40	27.0
		Above 20 years	36	24.3
		Below 5 years	37	25.0
5	Professional training in ICT	No training	33	22.3
		Short-term training	34	23.0
		Certificate course	44	29.7
		Advanced ICT training	37	25.0

The table contains the demographic description of 148 secondary school teachers who participated in the study. Regarding the age the 41-50 and above years category has the highest number of respondents at 31.8% then, 31-40 years at 24.3 and 50 years respectively at 22.3 and 21.6 respectively. As concerned gender, there are slightly a greater number of female teachers (52.0%), as compared to male teachers (48.0%). Concerning the school type,

the percentage rate of those working in government-aided schools is the highest (39.2%), the percentage rate in government and private schools is the same (30.4). In teaching experience, 27.0% of them have 11-20 experience. With regard to ICT training, most (29.7%) have certificate level ICT training, which means they are moderately exposed to digital professional training.

*Hypothesis 1: There is a significant positive relationship between professional development and teaching effectiveness among secondary school teachers in Patna district.*

Table 2: Correlation

Hypothesis	Factor			Correlation		Hypothesis Result
		Mean	SD	Pearson Correlation (r)	Sig value	
H1	Professional development	16.5405	4.45442	.321*	.000	Supported
	Teaching effectiveness	17.8851	3.51580			

\*. Correlation is significant at the 0.05 level (2-tailed).

The table presents the correlation between the teaching effectiveness and professional development of the secondary school teachers. The professional development mean score is 16.54 and its standard deviation is 4.45 and the mean of teaching effectiveness is 17.89 and a standard deviation of 3.52. The Pearson correlation value ( $r = 0.321$ ) shows that professional development and teaching effectiveness have a positive and moderate

relationship. The level of significance ( $p = .000$ ) is below the 0.05 mark indicating that the correlation is significant. The outcome of this shows that better teaching among the teachers is related to higher professional development. Hence, the null hypothesis is rejected and the alternative hypothesis is accepted which means that there is a significant relationship between professional development and teaching effectiveness.

*Hypothesis 2: Access to digital resources and ICT training significantly predict the digital literacy of secondary school teachers in Patna district.*

Figure 2: Regression Graph

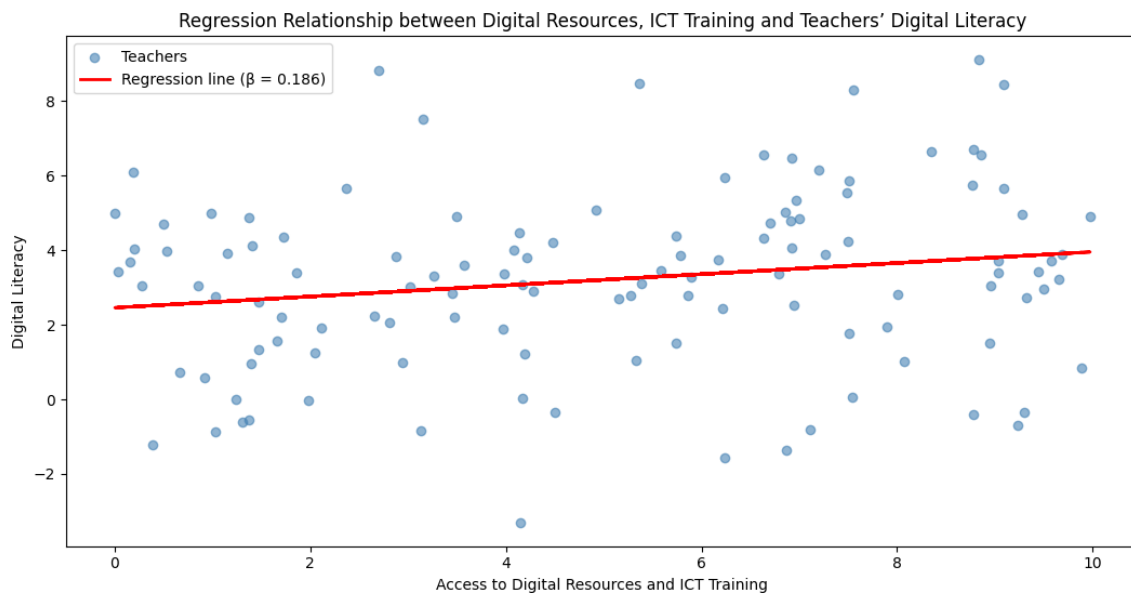


Table 3: Regression

Hypothesis	Regression Weights	Beta Coefficient	R2	F	t-value	p-value	Hypothesis Result
H2	Access to digital resources and ICT training > Digital literacy	.186	.034	5.210	2.283	.024	Supported

The relationship between access to digital resources and ICT training and teachers’ digital literacy can be expressed using the following simple linear regression model:

$$DL_i = \alpha + \beta(DRIT)_i + \varepsilon_i$$

Based on the regression results, the estimated model can be expressed as:

$$DL = \alpha + 0.186(DRIT) + \varepsilon$$

The regression coefficient ( $\beta = 0.186$ ) indicates that a one-unit increase in access to digital resources and ICT training is associated with a 0.186-unit increase in digital literacy among secondary school teachers, holding other factors constant.

The table stipulates the regression analysis of the influence of digital resource access and ICT training on the digital literacy of the secondary school teachers. The positive impact of increase in access to digital resources and ICT training on digital literacy is indicated by the beta coefficient of 0.186 which is positive. The value of  $R^2$  of 0.034 implies that this predictor accounts 3.4 percent of the variation in

digital literacy. The t-value of 2.283 having p-value of 0.024 which is not less than 0.05 signifies that the relationship is statistically significant. Thus, the null hypothesis is rejected and the alternative one is accepted and it proves that access to digital resources and ICT training has a positive effect on teacher digital literacy.

#### V. VARIABLE BASED DISCUSSION

- Professional Development of Secondary Teachers

The necessity of professional development of secondary teachers has become commonly known as a significant factor in improving the quality of teaching and solving the modern educational issues (Vashetina, O. V., et al., 2022). Individuals like Singh, S. K. (2025) stress on the concept of continuous professional development as the means of providing teachers with the newest pedagogical strategies and developing reflective practice that is a cornerstone of student-centered learning. In the same vein, Charania, A. et al., (2023) claims that successful professional development is not a one-time workshop, but a prolonged training process, collaboration with colleagues, and the possibility of applying new skills into the classroom. Regarding technological integration, a study by Ertmer demonstrates that ICT competency-based professional development is quite a successful way of boosting teacher confidence and effectiveness in instructions (Popova, A., et al., 2022). These views are echoed by Lahiri, S., et al., (2024) that reveal that the primary factor of overcoming the technological challenges faced by secondary teachers and enhancing the overall teaching performance in schools is the structured training programs, institutional support, and constant improvement of the skills of the former.

- Digital Literacy and Technological Skills

The digital competence and technological skills have started to be considered the critical competencies enabling teachers to work in the 21st-century classroom (Reddy, P., et al., 2023). Kaakandikar, R., et al., (2024) have found that effective integration of technology by teachers is not only a question of access to the devices but also the capacity of the teacher to effectively utilize digital tools with critical instruction. Malotiya, R., et al., (2023) points out that digital literacy does not only pertain only to operational abilities, but also includes information evaluation, online collaboration and

ethical utilization of technology that are essential in significant learning experiences. The studies of Oyetade, K. E., et al., (2020) also emphasize that effective ICT and continuous professional training aid in making teachers more confident and flexible in the classroom with a high amount of technology. The views of Chama, A. (2023) are congruent with them, stating that boosting digital literacy and technological abilities of secondary teachers in Patna district is the key to overcoming technological barriers and enhancing the effectiveness of the teaching process.

#### VI. CONCLUSION

The study points out that the influence of professional growth and availability of digital resources on the effectiveness and digital literacy of the secondary school teachers in the Patna district is great. The results show that the teachers that undergo ICT training and continuing professional development are more technologically competent and show improved instructional practices. The study suggests that policy makers and schools need to focus on organised online training and reinforcement of infrastructure to facilitate technology-enabled instruction. The study is however constrained by a narrow geographical location of the study and a small sample size which might influence the generalization of the findings. Further study ought to involve a larger and more heterogeneous sample of various areas and educational levels and also consider other variables such as institutional support, technological infrastructure, and teacher attitude towards digital learning to have a better understanding of enhancing digital literacy in education.

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