Original Researcher Article

Beyond Access: Evaluating the Cognitive and Socio- Emotional Outcomes of Digital Learning in Rural Odisha

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ABSTRACT

This study's objective is to assess the cognitive and socioemotional consequences of digital learning among rural learners in Odisha, going beyond just providing access to technology. A standardised Likert-scale questionnaire addressing dimensions including digital learning exposure, cognitive results, socio-emotional outcomes, and digital engagement was used to gather data from 384 respondents as part of a quantitative study design. To evaluate hypothesised correlations and mediation effects, data analysis used AMOS for structural equation modelling (SEM) and SPSS for descriptive statistics. The findings showed that exposure to digital learning having a substantial and beneficial impact on both cognitive and socioemotional outcomes, and strong structural validity was confirmed by model fit indices. Digital engagement partly mediated these associations, according to mediation analysis, which increased the beneficial impacts of exposure to digital learning on both outcome categories. Measurement robustness was proven using validity and reliability metrics. Overall, the results highlight that, in rural educational environments, maximising cognitive development and socio-emotional resilience requires both active digital engagement and access to digital resources....

Keywords: Digital Learning, Cognitive Outcomes, Socio-Emotional Outcomes, Digital Engagement, Rural Education, Online Learning, E-Learning
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1. INTRODUCTION:

The simplest definition of digital learning is "learning that is supported by technology." All modes of education that makes use of technology, including computers, the Internet, and mobile phones are together referred to as "digital learning." Online learning, m-learning, virtual learning, and e-learning are only a few of the many additional subjects it covers. It's

not really clear how to distinguish between all of them. This, however, is irrelevant when referring to them all by the same name (Mark david Walker, 2024).

Digital Learning includes:

Traditional face-to-face education, supplemented with technology.

Education delivered via a computer, smartphone, or other Internet-connected device; this is often conducted at a distance, so distance learning.

Blended learning; where there is a mix of traditional and computer-based learning

Mobile learning; where learning is completed using a mobile phone.

Use of online information sources; including databases, and information gained though personal study and research.

Digitising pre-existing educational materials is just one aspect of digital learning. It needs to be seen as a completely novel approach to education (Mark david Walker, 2024). By creating new opportunities and expanding the range of possible methods, technology enhances the educational process. The mix of methods that works best in each situation must be found and improved.
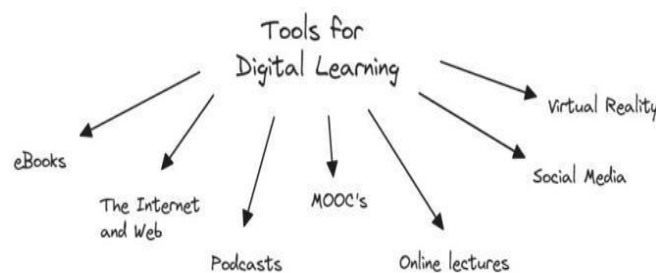
Online distance learning is just one aspect of digital learning! A situation where technology is utilised to improve instruction when the instructor and student are present is often overlooked.

Nearly every country in the globe is impacted by the COVID-19 pandemic's worldwide expansion, which has also led to a variety of public health reactions. The epidemic triggered the closure of a variety of organisations throughout the globe. To prevent the spread of the illness, governments throughout the world closed educational institutions as a physical barrier. Schools and instructors may employ distance education, educational apps, and platforms to connect with students and minimise disruptions to instruction (UNESCO, 2020). Online learning became a distant learning option in the Indian educational system around the early 2000s.

style of education requires access to digital gadgets as well as Internet connection. The tools utilised in this strategy include video conferencing, PDFs, instructive movies, and audio clipping. Apps such as Zoom, Google Meet, and Jio Meet are often used for video conferencing. WhatsApp and Telegram are used to share study materials with pupils.

During the lockdown, schools in Odisha stopped class promotion exams and promoted pupils based on term grades (Das et al., 2021). The new session began in April 2020 to prevent academic delays. The Government of Odisha's School and Mass Education Department switched to online education to restart teaching and learning. Rural kids may struggle with this education since they are used to a traditional classroom structure with a teacher there to guide and supervise their learning. Rural students are new to online learning.

The use of electronic technology to acquire instructional knowledge is known as e-learning. without a conventional classroom setting. In the ICT (Information and Communication Technology) era, people are more interested in learning via online courses and expanding their understanding of internet technology (T Sumallika, D Raju, 2022). E-learning is generally defined as the use of internet-connected information technology for educational purposes. It is composed of

Getting to and disseminating the educational resources.

Talking to other pupils and the tutors (teachers).

Asking for help throughout the learning process.

acquiring more information and improving one's experience

Online learning is a tool of the modern age. It is essentially a computer software. The Internet, an intranet, or an extranet are used to provide some or all of the career courses in this program. A good job is simply accessible via the online education segment (Mohammad Ibrar, 2012). Whether students are going back to school a few years later. of employment, have just graduated from high school, or just like to further their studies while holding a full-time job, India Academic is an excellent place to start looking into their educational possibilities.

Socio-emotional abilities predict important life outcomes, including health, employment, incomes, educational achievement, and criminal activity. Although socio-emotional abilities have been shown to have predictive potential, there is continuous discussion on their malleability (Sorrenti et al., 2025). If these abilities are flexible, then interventions aimed at children's socioemotional development might alter a person's life course and result in long- term adjustments to school achievement and employment outcomes.

According to the United Nations' fourth Sustainable Development Goal, education is essential for both personal and community growth. The Indian and state governments have implemented policies and initiatives to promote inclusivity and provide opportunities for education, economic development, and social advancement, emphasizing the incorporation of technology.

To address schooling issues, the government of Odisha, a significant Indian state, implemented the 5T governance model (Nag & Majhi, 2023). praised Odisha's 5T project as a crucial step towards ensuring equal access to excellent education. Recent research suggests that the 5T model is a promising approach to preparing learners with necessary abilities for the 21st century. With a focus on online and e-learning, this essay examines the paradigm-shifting effects of the 5T paradigm of education.

2. LITERATURE REVIEW

(Aashish & Rohit, 2024) examined the technological environment for providing sustainable, egalitarian, inclusive, and high-quality online education in rural India. The focus was on comprehending the issues, potential, and impact of technology used on improving educational results in rural places. The evaluation provided a thorough examination of a variety of topics, including student involvement, teacher preparation, infrastructure development, e-learning tool accessibility, and technology's revolutionary influence in altering traditional teaching methods. With a focus on the disparities in access to schooling and quality between rural and urban areas, the evaluation begins with an assessment of the current rural India's educational situation. Technology's potential to close these gaps is then thoroughly examined, with a focus on programs like digital classrooms, online learning environments, mobile learning applications, and digital material repositories that are utilized to improve accessibility and educational outcomes in remote locations.

The research (Tagat et al., 2025) assessed the program's short- and long-term effects on school- related outcomes and socio-emotional abilities, revealing its efficacy across different locations in India. The study started with baseline data, 18 months later, the midline data, and three years later, the final data. Research included harmonised from many studies, comprising 1898 youngsters for immediate analysis and 5582 for a long-term examination. In order to evaluate the effects of the program on outcomes including Gender views, resilience, self-efficacy, and school attendance, empirical approach involves analyzing panel data with models for multiple linear regression. Participants' objectives, socioemotional abilities, and school attendance all showed significant gains were found in the short-term study. The C2L raised perceived self- efficacy by 4% and liberal gender attitudes by 0.6% in the short run.

(Bochicchio et al., 2018) purposed of this study was to give a comprehensive evaluation of studies evaluating how digital play affects children's cognitive and socioemotional development between the ages of two and eleven. Five papers that met the requirements to be included in the review were found by full text screening after a thorough evaluation of publications that could be relevant to the subject. The findings demonstrated that the role of online gaming in children's development was very complicated, with both good seen both positive (such as pro-social behaviors and social anxiety) as well as negative (such as anti- social behaviors and isolation) outcomes.

The research (ANDRADE et al., 2025) suggested four steps of methodology: analysing socio- emotional skills while using DICTs, and designing digital tasks and activities that would increase social interaction and elementary school students' ability to concentrate from the viewpoint of elementary school instructors. Results from the implementation and validation of the method showed that the integration of educational activities with DICTs that were customised based on students' actual access to technology helped students develop socioemotional skills. This was due to the fact that in virtual courses, there were good benefits in terms of group dynamics and individual task organization, where students showed collaboration and empathy with peers who struggled to use the DICTs.

Development of Hypothesis

This research (Saarinen et al., 2021) looked at the potential relationship between Finnish students' learning results and ICT usage in the classroom. We utilized Finland's PISA 2015 data (N=5037). Using computer-based assessments, cognitive learning outcomes such as science, math, reading, and creative problem-solving were assessed. Students' reported ICT proficiency, availability, its utilization in the classroom were evaluated by self-rating surveys. Even after adjusting for age, gender, parental income, kids' ICT competence, and access to ICT at school, frequent use of ICT at school was still associated with worse success in all mental learning outcomes. This research also implies that while ICT-skilled students are proficient in the mechanical used of digital devices, they could lack the capacity for goal-oriented and self- directed use of these tools, which might aid in their learning.

(Di Giacomo et al., 2017) examined the performance of a sample made up of 191 school-age children who were divided into two user groups: high and low digital users. evaluated children's employing an ad hoc self-report questionnaire to assess verbal and visuoperceptual cognitive skills and eight standardised psychological tests. The findings demonstrate how

internet exposure affects cognitive growth, as seen by higher scores on tests of naming, semantics, visual memory, and logical reasoning among heavy computer users.

This research (Shi et al., 2021) evaluated empirical papers on students' cognitive learning outcomes and used a meta-analysis to estimate the overall efficacy of IWB-based training. 23 excellent, peer-reviewed journal papers that satisfied the inclusion requirements were found via a

thorough database search and literature assessment. Using Review Manager 5.3 software, the meta-analysis was carried out. The computed effect size demonstrated that, in contrast to conventional lecture-based lectures, IWB-based education may have a favourable impact on students' cognitive learning results. The pedagogical method and the year of release seem to considerably modify the efficiency of IWB-based training, according to a moderator variable analysis. According to multidisciplinary study studies, these findings show that IWB-based teaching has developed over time after years of use in educational settings, assisting students in enhancing their cognitive learning.

According to (Algan & Huillery, 2025) economic studies conducted over the last 20 years, socio-emotional competencies including collaboration, self-control, development mindset, self-esteem, and trust provide a threefold dividend for both people and society. First, socio- emotional therapies show that these abilities significantly improve school success and academic performance. Second, the success of people on the job market and their professional integration are greatly influenced by such talents. Third, they improve people's long-term well- being by lowering anxiety, depression, and criminality while also improving health. Additionally, there is evidence to show that socio-emotional abilities are associated with improved social and economic success at the national level. The evidence strongly suggests that redesigning educational systems in the future by incorporating socio-emotional skills into the core curriculum of teacher training and into regular pedagogical methods could be very beneficial to realise individual potentialities and build resilient economies, societies, and democracies, especially considering the extremely high cost-benefit ratio of such interventions.

(Li et al., 2024) purposed of this study was to fill in some of the blanks in the current literature by using a mixed-methods strategy based on contextual cognitive theory and behaviourist learning theory. Students at three different universities in Thailand were given access to a comprehensive questionnaire. After removing invalid answers, a solid for analysis, a sample of 434 valid replies was selected. Empirical studies were carried out using SPSS and MPLUS software to investigate how pupils' propensity to study is affected by instructional digital

games. The study's conclusions demonstrate that: First, learning engagement acts as a mediator between digital learning games and pupil motivation to study; second, learning involvement has a positive effect on students' drive to acquire knowledge; finally, the digital setting modifies the connection between pupils' learning engagement and digital instructional games. In particular, pupil engagement is more positively impacted by digital educational games in a deeper digital environment.

The research (Lin et al., 2024) aimed to investigate the connections between digital reading, metacognitive techniques, and information and communication technology (ICT) engagement. In particular, used data from PISA 2018 to investigate whether (a) digital reading was negatively impacted by The behavioral component of using ICT, (b) The motivating element of ICT interaction

has a beneficial effect on digital reading, and (c) Metacognitive methods controlled or managed the relationship between online reading and ICT participation. Our results showed that (a) The behavioral and motivational components of ICT use had a favorable effect on online reading, while (b) the behavioural and social motivational aspects of ICT use has significant negative indirect effects on the success of digital reading via metacognitive methods, but the cognitive methods differently moderated all other ICT involvement motivating factors; and (c) Digital reading was negatively impacted by the behavioral and motivational components of ICT engagement, although ICT social incentive had a mediated and moderated influence on ICT engagement.

This research (Wu, 2023) examined how intermediate Chinese English as a Foreign Language (EFL) students interact with Online Learning Self Efficacy (OLSE), Informal Digital Learning of English (IDLE), online class participation, and the mediating role of Social Presence (SP). A network of language schools offered online English lessons to 389 students, who made up the study sample. In order to gather data, validated measures were used to evaluate online student engagement, OLSE, IDLE, and SP. Additionally, using SP to partially mediate the impact, IDLE had a favourable effect on online student engagement. This implies that students' participation in online classrooms is greatly influenced by informal digital English learning, and that this effect is made possible by the feeling of social presence that students get from virtual interactions.

3. RESEARCH GAP

The examined research shows significant advancements in our knowledge of how students' cognitive and behavioural outcomes in a variety of circumstances are impacted by digital

learning, ICT integration, and the development of socioemotional skills. Research has looked at a number of topics, including the differences in access and infrastructure in rural India, the impact of digital play, family environments, and focused socio-emotional interventions, as well as the effects of online engagement, interactive whiteboard use, and digital educational games on learning outcomes. There are still a number of research gaps, however. First, there is little empirical research on how digital learning especially impacts cognitive and socio-emotional results in rural situations, where pedagogical and infrastructure problems are different, even though the majority of the data is derived from urban or mixed settings. Second, whereas earlier research emphasises the significance of socio-emotional skills, few have combined them with tests of cognitive learning in a unified analytical framework to investigate their relationships. Third, the majority of research focusses on either access or direct effects, leaving mediation mechanisms—like the contribution of digital engagement to improving learning outcomes—understudied. Fourth, there aren't any large-scale, statistically sound models that can confirm the connections between digital exposure, engagement, and multifaceted learning outcomes; instead, much of the research that has already been done uses qualitative or small- scale quantitative approaches. Last

but not least, contextual differences—like the distinct socioeconomic and cultural circumstances of rural Odisha—remain under-represented in the research, necessitating the development of data-driven, region-specific insights to inform successful policy and practice.

4. METHODOLOGY

Research design

The study used a qualitative technique as one of its research approaches to examine the Beyond Access: Assessing Digital Learning's Cognitive and Socio-Emotional Effects in Rural Odisha. A systematic online A survey was used to collect data from 384 participants. The validated questionnaire used to gather the data consisted of Likert-scale questions. "Statistical software for the social sciences," or SPSS, was employed to examine the data. AMOS (Analysis of Moment Structures) for structural equation modeling (SEM) was used to evaluate the suggested hypotheses. which also looked at the relationships between the main variables.
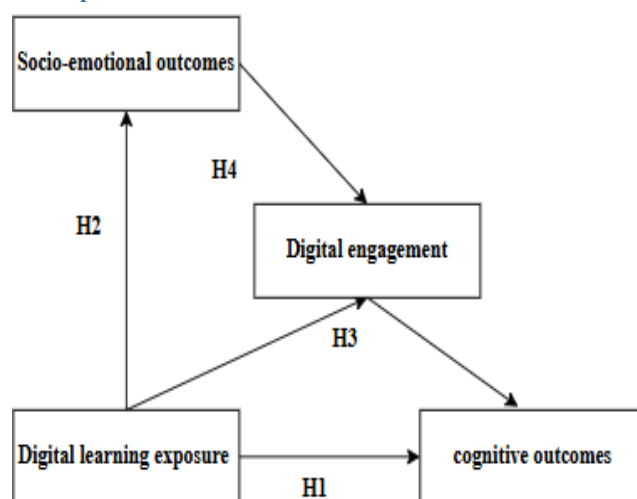
Conceptual frame work

Figure 1 Conceptual frame work

Hypothesis

H1: Digital learning exposure is positively and significantly associated with students' cognitive outcomes after controlling for baseline scores.

H2: Digital learning exposure is positively and significantly associated with socio-emotional outcomes such as grit, growth mindset, and self-regulation.

H3a: The relationship between digital learning exposure and both cognitive outcomes are partially mediated by digital engagement.

H3b: The relationship between digital learning exposure and both socio-emotional outcomes are partially mediated by digital engagement.

Sample selection

479 persons made up the sample size employed in the investigation. in order to provide a representative dataset for analysis will be obtained using the stratified random sampling technique. investigated the Beyond Access:

Evaluating the Cognitive and Socio-Emotional Results of Digital Education in Rural Odisha.

Data collection

Research used a quantitative approach, ensuring accuracy and reliability via the use of systematic data collection methodologies. A standardized several Likert-scale observations questionnaire was used as the main tool for collecting data in order to evaluate the Beyond Access: Assessing Digital Learning's Cognitive and Socio-Emotional Results in Rural Odisha.

Important questionnaire elements are Constructs, Digital Learning Exposure, Cognitive Outcomes, Socio Emotional Outcomes and Digital Engagement. Google Forms was used to collect 479 legitimate replies. To represent the variety of the population, the sample included a range of income levels and a balanced mix of genders. Secondary data from published studies, government websites, and institutional records will be used to augment the original data.

Measures

To gather information, a methodical questionnaire was used. The questionnaire asks respondents to score their opinions on the several study topics under investigation use a five- point Likert scale, with strongly disagree and strongly agree as the extremes. The questionnaire contains both open-ended and closed-ended questions. Well-thought-out questions have been created to gather pertinent information on the variables being studied. A distinct questionnaire has been developed for each of the five types of respondents who make up the survey. The table below lists the variables and quantity of objects included for the study.

S. No	Variable Name	No. Items
1	Constructs	5
2	Digital Learning Exposure	5
3	Cognitive Outcomes	5
4	Socio Emotional Outcomes	5
5	Digital Engagement	5

5. RESULTS

Introduction

The results of the research provide a comprehensive analysis of the connection between rural learners in Odisha's exposure to digital learning and their cognitive and socioemotional outcomes, as well as an investigation into the mediating function of digital engagement.

Evaluations of the measuring tools' validity and reliability revealed that they were sound, with

each concept exhibiting good convergent validity and high internal consistency. The sample as a whole had moderate to high levels of exposure to, engagement with, and perceived advantages from digital learning, according to descriptive statistics. Digital learning exposure have a substantial and beneficial impact on both socioemotional and cognitive results, as per hypothesis testing using structural equation modelling (SEM), with digital engagement showing partial mediation effects. The suggests framework's sufficiency and statistical soundness in describing how access, when combine with active participation, might improve academic achievement and personal growth in rural educational settings are confirmed by model fit indices that regularly reach suggests levels.

Demographic variables

Demographic Variable	Category	Frequency	Percentage
Gender	Male	250	52.2
	Female	229	47.8
	Total	**479**	**100**
Age	10–14 years	95	19.8
	15–18 years	102	21.3
	19–22 years	88	18.4
	Above 22 years	94	19.6
	Total	**479**	**100**
Educational Qualification	Primary (up to Class 5)	122	25.5
	Secondary (Class 6–10)	118	24.6
	Higher Secondary (Class 11–12)	119	24.8
	Graduate and above	120	25.1
	Total	**479**	**100**
Family Income Level (Monthly)	Below ₹10,000	125	26.1
	₹10,001 – ₹20,000	118	24.6

	₹20,001 – ₹30,000	115	24
	Above ₹30,000	121	25.3
	Total	**479**	**100**
	Own personal device	124	25.9
	Shared device in family	120	25.1
Access to Digital Devices	Community/School-based device	118	24.6
	No access to device	117	24.4
	Total	**479**	**100**

Variables	Mean	Std. Deviation
Digital Learning Exposure	3.6610	.84880
Cognitive Outcomes	3.5835	.87328
Socio Emotional Outcomes	3.7223	.89097
Digital Engagement	3.5835	.87328

The primary trend is summarized by the statistical data variability of the studied variables. Digital Learning Exposure recorded The greatest average score (M = 3.6610, SD = 0.84880), showing pupils often perceived moderate to high levels of exposure to digital learning possibilities. Socio-Emotional Outcomes had a high score (M = 3.7223, SD = 0.89097), suggesting that learners saw favourable social and emotional advantages from digital learning. The mean values for Cognitive Outcomes and Digital Engagement were both 3.5835, with standard deviations of 0.87328, indicating a modest amount of reported cognitive improvements and interaction with digital platforms. The comparable standard deviation values across variables indicate a uniform distribution of answers, implying that learners' judgements did not significantly differ within the sample.

Hypothesis Implementation:

H1: Digital learning exposure is positively and significantly associated with students' cognitive outcomes after controlling for baseline scores.

Internal Consistency and Convergent Validity

Constructs	Cronbach's Alpha	AVE	Composite Reliability
Digital Learning Exposure	0.849	0.7147	0.8038
Cognitive Outcomes	0.774	0.60	0.6459
Socio Emotional Outcomes	0.905	0.7002	0.8671
Digital Engagement	0.793	0.7183	0.7233

The analysis of internal consistency and convergent validity indicates that all four variables in the study Digital Learning Exposure, Cognitive Outcomes, Socio-Emotional Outcomes, and Digital Engagement showed adequate measures of reliability and validity. Scores for Cronbach's alpha varied from 0.774 for Cognitive Outcomes to 0.905 for Socio-Emotional Outcomes, all above the 0.70 benchmark, indicating robust internal consistency. The Average variation Extracted (AVE) values above the recommended cutoff 0.50, originating from 0.60 to 0.7183, so affirming that each construct accounted for enough variation of its indicators.

Likewise, Composite dependability scores, although differing across components, generally above the 0.60 threshold, with the greatest dependability seen in Socio-Emotional Outcomes

(0.8671). The findings together affirm that the measuring technique is accurate and valid for capturing the intended dimensions within the context of digital learning in rural Odisha.

Mean and standard deviation
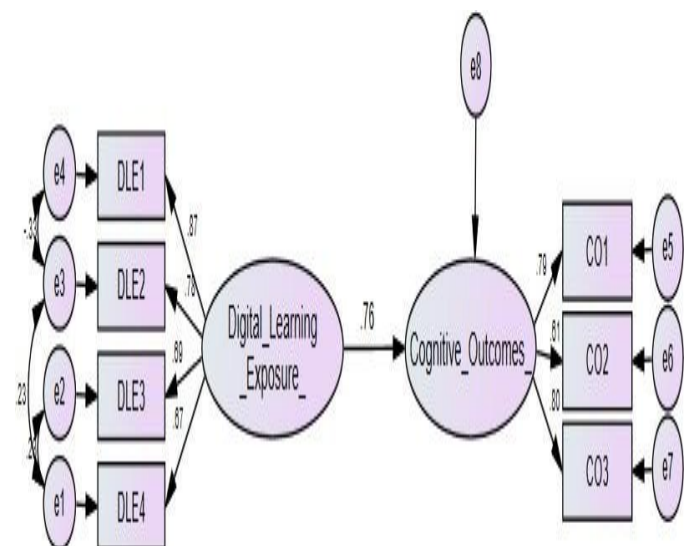
Regression Weights: (Group number 1 - Default model)
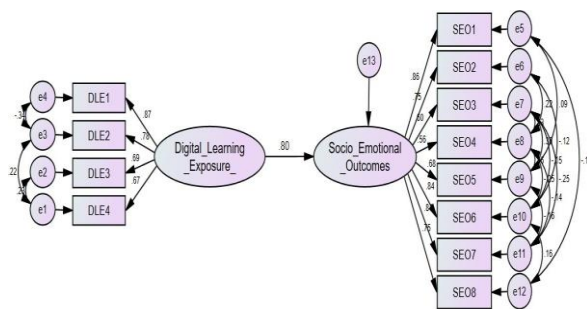
Path			Standard Estimate	S.E.	C.R.	P
Cognitive Outcomes	<---	Digital Learning Exposure	.757	.079	11.608	***

The regression analysis for H1 shows that Digital Learning Exposure has a robust and statistically significant beneficial influence on Cognitive Outcomes, even adjusting for baseline scores. The standardised estimate of 0.757 indicates a significant effect, while the critical ratio (C.R.) of 11.608 validates the strength of the association. The standard error (0.079) is comparatively low, and the p-value is very significant (p < 0.001), shown by three asterisks. These data unequivocally validate Hypothesis 1, indicating that increased exposure to digital learning substantially improves students' cognitive outcomes in rural Odisha.

model fit Summery

CMIN	DF	CMIN/DF	GFI	NFI	RFI	IFI	CFI	RMR	RMSEA
26.724	10	2.672	.984	.982	.962	.988	.988	.023	.059

The model fit indices show a high degree of agreement between the observed data and the suggested model. The chi-square statistic (CMIN = 26.724, DF = 10) produces a CMIN/DF ratio of 2.672, which is inside the acceptable threshold (< 3), indicating a satisfactory model fit. Goodness-of-fit indices, including GFI (.984), NFI (.982), RFI (.962), IFI (.988), and CFI (.988), all above the suggested criterion of .90, indicating exceptional model adequacy. Moreover, the RMR value (.023) is very low, further validating the model's precision. The

RMSEA score (.059) is within the threshold of .08, demonstrating how well the model fits the data. Indicators together affirm that the suggested structural model is statistically robust and suitable for elucidating the link between digital learning exposure and cognitive outcomes.

H2: Digital learning exposure is positively and significantly associated with socio- emotional outcomes such as grit, growth mindset, and self-regulation.

Regression Weights: (Group number 1 - Default model)

Path			Standard Estimate	S.E.	C.R.	P
Socio Emotional Outcomes	<---	Digital Learning Exposure	.804	.087	13.456	***

The regression analysis for H2 shows that Digital Learning Exposure has a positive and substantial correlation with students' socioemotional results, including self-control, development attitude, and tenacity. The standardised value of 0.804 signifies a robust predictive correlation, indicating that increased exposure to digital learning significantly improves kids' socio-emotional development. The critical ratio (C.R.) of 13.456, significantly above the threshold of 1.96, validates the strength of this impact. The standard error of 0.087 and a very significant p-value (p < .001) offer compelling evidence for Hypothesis 2, indicating that digital learning exposure significantly enhances socio-emotional development in rural learners.

model fit Summery

CMIN	DF	CMIN/DF	GFI	NFI	RFI	IFI	CFI	RMR	RMSEA
103.738	37	2.804	.966	.970	.947	.981	.981	.041	.061

According on the model fit indices, the suggested model elucidating the connection between digital learning exposure and socio-emotional outcomes exhibits a satisfactory and robust fit with the data. The chi-square statistic (CMIN = 103.738, DF = 37) yields a CMIN/DF ratio of 2.804, which is within the acceptable range (< 3), indicating a reasonable match. The goodness- of-fit measurements reinforce this conclusion, with GFI (.966), NFI (.970), IFI (.981), and CFI (.981) all beyond the suggested threshold of .90. The RFI (.947) also demonstrates a dependable model specification. The RMR value (.041) is minimal, and the RMSEA value (.061) is under the acceptable threshold (< .08), indicating that the model well aligns with the actual data. These

indicators together affirm the model's adequacy and dependability, substantiating the predicted correlation between digital learning exposure and socio-emotional outcomes.

H3a: The relationship between digital learning exposure and both cognitive outcomes are partially mediated by digital engagement.
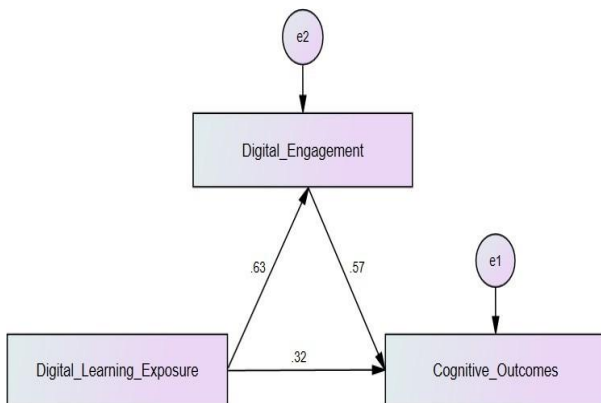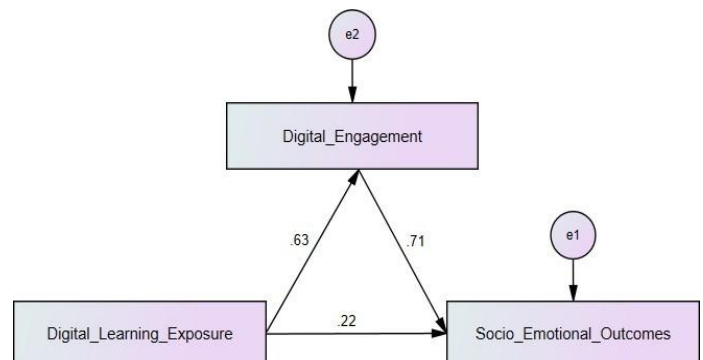

Regression Weights: (Group number 1 - Default model)

Path			Standardrd Estimate	S.E.	C.R.	P
Digital Engagement	<---	Digital Learning Exposure	.627	.032	17.578	***
Cognitive Outcomes	<---	Digital Learning Exposure	.318	.036	9.199	***
Cognitive Outcomes	<---	Digital Engagement	.571	.040	16.535	***

The regression findings for H3a show significant evidence of partial mediation by Digital Engagement in the association between Digital Learning Exposure and Cognitive Outcomes. Digital Learning Exposure is a significant predictor of Digital involvement, shown by a high standardised estimate of 0.627 (S.E. = 0.032, C.R. = 17.578, p < .001), indicating that more exposure substantially improves students' involvement with digital platforms. Digital Engagement is a substantial predictor of Cognitive Outcomes, shown by a standardised estimate of 0.571 (S.E. = 0.040, C.R. = 16.535, p < .001), underscoring its pivotal function in facilitating learning advancements. Furthermore, Digital Learning Exposure maintains a direct, although diminished, impact on Cognitive Outcomes (standardised estimate = 0.318, S.E. = 0.036, C.R. = 9.199, p < .001). The continuation of this direct route in conjunction with the indirect channel via engagement substantiates that Digital Engagement partly mediators the link. The results indicate that exposure to

digital learning directly fosters cognitive growth, with its effects significantly enhanced by active digital interaction.

H3b: The relationship between digital learning exposure and both socio-emotional outcomes are partially mediated by digital engagement.

Regression Weights: (Group number 1 - Default model)

Path			Standard Estimate	S.E.	C.R.	P
Digital Engagement	<---	Digital Learning Exposure	.627	.032	17.578	***
Cognitive Outcomes	<---	Digital Learning Exposure	.223	.031	7.516	***
Cognitive Outcomes	<---	Digital Engagement	.706	.035	23.804	***

The regression analysis for H3b shows that Digital Engagement performs substantial partially mediating the relationship between Digital Learning Exposure and socio-emotional outcomes. Digital Learning Exposure is a significant predictor of Digital involvement, shown by a standardised estimate of 0.627 (S.E. = 0.032, C.R. = 17.578, p < .001), suggesting that more exposure fosters elevated student involvement with digital resources. Digital Engagement has a robust and substantial beneficial influence on socio-emotional outcomes, shown by a standardised estimate of 0.706 (S.E. = 0.035, C.R. = 23.804, p < .001). Significantly, Digital Learning Exposure has a direct impact on socio-emotional outcomes, although with a lesser standardised estimate of 0.223 (S.E. = 0.031, C.R. = 7.516, p < .001). The presence of substantial direct and indirect pathways indicates partial mediation, implying that while digital exposure directly improves socio-emotional outcomes, the impact is

significantly amplified when students actively participate in digital learning platforms.

6. DISCUSSION

This study's results highlight the multiple effects of exposure to digital learning on the intellectual and emotional growth of Odisha's rural pupils. The high internal consistency and validity metrics validated the strength of the notions, although pupils frequently described moderate to high levels of exposure, according to the descriptive data, engagement, and favourable outcomes. Hypothesis testing corroborated these findings, identifying digital learning exposure as a key predictor of cognitive and socio-emotional outcomes, highlighting its contribution to critical thinking, problem-solving, resilience, growth mindset, and self- regulation. The mediation studies (H3a and H3b) indicated that digital engagement partly mediators these connections, indicating that while exposure alone has a direct beneficial effect, its influence is significantly enhanced when learners actively engage with digital tools and platforms. This dual approach highlights that genuine interaction, rather than mere access, acts as the catalyst that transforms exposure into profound learning advancements and socio- emotional resilience. The findings together affirm the hypothesised model with robust fit indices and demonstrate that successful integration of digital learning in rural settings may promote both academic and personal development, contingent upon the cultivation of engagement alongside exposure.

7. CONCLUSION

This study's results confirm that exposure to digital learning is essential for improving cognitive and socio-emotional outcomes for students in rural Odisha, with digital engagement serving as a major partial mediator. The reliability and validity evaluations indicated that the constructs were resilient and appropriate for assessment. Hypothesis testing demonstrated that exposure to digital learning significantly impacted cognitive and socio-emotional outcomes, including grit, growth mindset, and self-regulation, while also exerting indirect impacts on these outcomes via digital engagement. The mediation findings highlighted that while digital exposure alone aids learning, its impact is enhanced when learners actively connect with digital platforms. These findings together underscore that, in addition to access to digital resources, cultivating meaningful interaction is crucial to optimise the cognitive and socio-emotional advantages of digital learning in rural contexts:.

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