International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 09 | Sept - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

"Smart Villages: Digital Education and Skills Development for Rural Growth,"

M.Sireesha

Student-2nd year

Aurora deemed to be university Hyderabad sirreshavenkata@gmail.com

M. Praharsha

Student-2nd year

Aurora deemed to be university Hyderabad mattapraharshareddy@gmail.com

Y. Vaishnavi

Student-2nd year

Aurora deemed to be university Hyderabad vaishnaviyadav5133@gmail.com

I. Abstract

The project, "Smart Villages: Digital Education and Skills Development for Rural Growth," focuses on bridging the rural-urban divide by leveraging digital tools and skills development programs to empower rural communities. Limited access to quality education and skills training often hinders the socioeconomic progress of rural areas. This initiative aims to introduce digital literacy, vocational training, and entrepreneurial skill-building to enhance self-reliance and economic sustainability. Through comprehensive research, the project identifies challenges such as inadequate infrastructure, limited awareness, and accessibility barriers. It explores scalable solutions like e-learning platforms, mobile-based education, and community-driven training programs. By involving stakeholders such as governments, NGOs, and private entities, the project emphasizes creating an inclusive ecosystem for rural transformation. The anticipated outcome includes improved digital literacy, enhanced employability, and overall rural development, contributing to sustainable growth and narrowing the rural-urban gap. This study provides actionable strategies for fostering smart and self-sufficient rural communities.

II. Introduction :

Using the power of education and technology, the idea behind "Smart Villages: Digital Education and Skills Development for Rural Growth" is to turn rural communities into centres of opportunity and innovation. Limited access to chances for skill development and high-quality education impedes socioeconomic advancement in many rural communities. The goal of this project is to close these gaps by utilising digital technologies, e-learning platforms, and skill-building initiatives to equip rural communities with information and useful skills. To promote self-sufficiency, entrepreneurship, and sustainable development, the project will incorporate digital literacy, vocational training, and advanced skill-building programs. The program is in line with international initiatives to close the gap between rural and urban areas, enabling rural populations to engage in the digital economy and enhance their standard of living.

The project's ultimate goal is to develop a scalable, inclusive, and significant paradigm for rural change that promotes growth while maintaining cultural identity.

Need of the study :

Rural communities often face challenges like inadequate education, limited skill development, and a lack of digital access, which hinder their economic and social progress. This study is essential to address these disparities by exploring ways to integrate digital education and skills training into rural development initiatives. By empowering rural populations with knowledge and practical skills, the study aims to promote self-reliance, reduce the rural-urban gap, and contribute to sustainable growth and overall rural upliftment.

Objectives of the study:

- To assess the current state of digital education and skills development in rural areas.
- To identify the key challenges and barriers hindering access to education and skill training in rural communities.
- To explore the potential of digital tools and technologies in enhancing education and vocational training for rural populations.
- To develop strategies for implementing sustainable and scalable digital education and skill development programs.
- To evaluate the impact of digital education and skills training on rural economic growth and self-reliance.

Scope of the study

This study focuses on enhancing rural development through digital education and skills development. It examines how digital tools, e-learning platforms, and vocational training programs can address gaps in education and skill-building for rural populations. The study covers areas such as digital literacy, advanced technical skills, entrepreneurship training, and employment opportunities. It also explores the role of government policies, NGOs, and private sector involvement in creating scalable and sustainable models for rural transformation. The findings aim to provide actionable insights for bridging the rural-urban divide and fostering economic growth in rural areas.

Limitations of the study:

1. **Access to Technology**: Limited internet connectivity and infrastructure in some rural areas may hinder the effective implementation and participation in digital education programs.

2. **Resource Constraints**: Financial and logistical challenges may restrict the scale of digital education and skills development programs, limiting the study's reach and impact.

3. **Data Availability**: The lack of comprehensive data on rural education and skills development may pose challenges in accurately assessing the current situation and measuring the success of interventions.

III. Literature review

Bokun and Nazarko **(2023)** developed Smart villages concept. The method used was bibliometric analysis and state-of-the-art literature review. The article determines the current state-of-the-art smart village concept based on a bibliometric analysis of scientific articles collected from the Web of Science, Scopus, and IEEE Xplore databases and a qualitative

document analysis of the significant smart village initiatives. The authors highlight the multidimensionality of the concept, propose its contemporary definition, and identify its basic dimensions: people, economy, living, energy, environment, mobility, and governance, thus creating a methodological basis for the planning, design and implementation of smart village projects.

Galiwango et al. **(2022)** studied the climate-smart village extension model. Climate-smart villages (CSVs) are new and promising approaches to tackle climate change's negative repercussions and food insecurity affecting nearly one billion people globally. CSVs are envisaged to result in the empowerment of participating farmers; however, limited literature exists, given the novelty of this concept in different geographical spheres. This review paper, therefore, conducted a systematic analysis of some previous studies around this concept and assessed their contribution to understanding the empowerment of farmers regarding intrinsic, instrumental, and collective agency. From the results, these studies evaluated empowerment as majorly in line with the female gender; some focused on both. Results lacked focus on empowerment in the intrinsic, instrumental, or collective agency realms, though the possibility of using proxy concepts can't be dismissed. However, at the heart of any agricultural extension model, a clearly outlined gender- inclusive farmer empowerment pathway should be a fundamental cornerstone for sustainability.

Gerli, Navio Marco and Whalley (**2022)** studied characteristics of a smart village. The method used was a literature review. The authors found that disciplinary backgrounds and geographical contexts currently shape the definition and characterisation of smart villages. The authors found that a Smart village is often viewed as the rural version of a smart city or an innovative model for rural development. Still, there has been little engagement in the literature with other debates around rurality and sustainable development.

Kasinathan et al. (**2022)** studied how the realisation of sustainable development goals is possible by applying disruptive technologies and integrating concepts of Industry 5.0, Society 5.0, and Smart Cities and Villages. This study analyses disruptive technologies' outcomes from product development and healthcare transformation, as well as a pandemic case study, nature-inclusive business models, and smart cities and villages. These outcomes are mapped as a direct influence on Sustainable Development Goals 3, 8, 9 and 11. Various disruptive technologies are elaborated. The corresponding impact on the Sustainable Development Goals is mapped. A SWOT analysis assesses the proposed integrated approach to achieve Sustainable Development Goals. Ultimately, this study can assist industrialists, policymakers, and researchers envision sustainable development goals from technological perspectives.

Satola and Milewska, (**2022)** developed the concept of a smart village as an instrument for implementing public tasks in rural areas. The authors found that applying the smart village concept in Poland gives municipalities the possibility of an innovative approach to implementing local public services. The authors also presented examples of good practices implemented by rural local communities that can act as models for other groups of residents are also included. The method used is critical literature review and analysis. The authors presented how the smart village concept improves public service delivery in rural areas. The authors found that there is no universal model for a smart village and therefore smart village should be implemented as solutions tailored to the economic, social, cultural, and natural conditions of a particular rural area.

Stein et al. **(2022)** studied digitalisation and civic participation in rural areas. The authors discovered that the smart village is digitally networked and participatory based on the interaction between technological infrastructures and civic engagement. The authors found that understanding of the interaction between digitalisation and civic participation in rural areas remains limited. This paper offers a systematic review of journal contributions at the intersection of digitalisation, participatory efforts and rural development to fill this gap. Authors found: (1) research focuses primarily on projects seeking to increase broadband capacity. (2) research focuses on rural areas' spatial characteristics, where social relations and intermediaries are essential. (3) published articles emphasise integrating top-down measures with bottom-up initiatives. Authors found that there is no single, dominant theoretical approach conceptualising the intertwining of digitalisation and civic participation processes in rural areas

Bayala et al. **(2021)** studied the co-implementation of a climate-smart village. The authors found that climate change and variability present significant environmental and food security challenges worldwide. Climate information (CI) was used as an entry point to inform the development of technologies and practices within Climate-Smart Villages (CSV). This groundwork has led to a greater understanding of three critical factors for successful CSV implementation:

(1) Building solid partnerships to co-design and develop agricultural systems that improve ecosystem and population resilience, (2) Key stakeholders (researchers, farmers, development agents, and students) capacity strengthening through vocational and academic training, and (3) Using CI for livelihood planning at all scales. These three factors support more

effective identification and testing of agricultural technologies and practices addressing climate variability and change at plot, community, and landscape levels. The paper discusses the PAR-CSA methodology and parameters for evaluation, including biophysical and social change.

Zougmore, Laderach and Campbell, **(2021)** found that smart villages can be applied to mitigate climate pressure and develop climate-smart agriculture. The article analyses the nexus of "climate-smart agriculture-food systems" and "sustainable development" to rapidly transform food systems in the context of climate change pressure. The method used is an integrative review approach.

Adesipo et al. (**2020)** considered climate-smart agricultural trends core aspects of smart village functions. The paper examines the progress of climate-smart agriculture and tries to borrow from its ideals to develop a framework for smart village development. The authors found that the studies and results generated around climate-smart agriculture can be adopted in planning villages and transforming them into smart villages. Therefore, the authors argue that smart agricultural techniques must be prioritised to develop the smart village framework effectively

Zavratnik, Superina, and Duh (**2019)** studied living labs in rural areas, emphasising frameworks, concepts, and practices. The authors studied the value of the Living Lab concept in creating environments that enable equal opportunities for people living in rural and urban areas and make rural areas attractive places to live. This paper argues that community and social change should be considered key elements in enabling sustainable living.

Zavratnik, Kos and Duh (**2018)** prepared a comprehensive review of initiatives and practices for developing smart villages. The authors have reviewed already existing practices. The authors focused on the existing implementations of the Smart Village concept and the importance of digital transformation for rural areas. The authors gave special attention to EU policies as the framework for understanding. The authors have shown the parallels between the experiences from different regions and evaluated the practices presented. The authors found out that that smart rural development has to be applied in combination with place-based approach. Authors have presented the cases of Slovenian pilot practices. Authors presented the FabVillage concept.

Dhanamalar M, Preethi S, Yuvashree S; (**2020)** examined that, urban women have reached a specific level of self-reliance wherein their dependence on others has reduced over the years when compared to the state of rural women. This dependency level of the rural women in India has led to various issues such as their being misled and defrauded. According to a survey conducted by NSSO, rural women's literacy rate is significantly lower that of urban women. In addition to a better level of education, there is a large gap between urban women and rural women in terms of technology usage. After the onset of globalization in 1990, technology was initially a male-dominated field but with the increasing involvement of urban women over the years the usage of technology has increased among them. Despite the promises of the digital revolution, rural women still do not have the same access to information and technology, as urban women in India.

Xiao Han (**2018)** reported that the Internet has experienced dramatic technological development since the late 1980s, fierce debates about the empowering potential of the Internet for women's liberation have also raged. In particular, feminist theorists have grasped this opportunity to enquire whether women can become empowered by the Internet. However, the existing feminist research lacks systematic theoretical frameworks that would help us investigate what roles digital media play in the process of women's empowerment. This sets the scene for creating possible theoretical links between digital media and women's empowerment. The role of Chinese women's groups in the process of women's empowerment will be presented to demonstrate the explanatory value of the framework.

Malhotra Ruchi (**2015)** indicates that Information technology has revolutionized the world as never before. The benefits accrued from the synergy of knowledge and IT need not be restricted to the upper strata of the society but have to freely flow to all segments of the female population. IT sector is considered to be no-discriminating. It is considered to be an equal opportunity employer for men & women. IT are powerful tools for women to use to overcome discrimination, achieve full equality, well-being and participation in decisions that impact the quality of their lives and the future of their communities.

Gurumurthy, (**2013)** stated that digital ICTs and media also represent a commercial space, influenced by private sector interests. This means existing patriarchal attitudes towards gender can be reproduced as well as challenged in the online environment in ways that can limit the potential of ICTs to be tools for women's empowerment.

Asiedu (**2012)** criticises ICT and development discourse for using the 'language of empowerment' while at the same time presenting women as 'passive recipients' of ICTs rather than examining whether they are able to be 'active users'.

Even when women are passive users of ICTs, this can increase their access to services and information in ways that empower them and provide an important base for voice and influence. However, for women to use ICTs to voice their views and influence others, they need also to be active users of digital ICTs.

Smart rural development in India can reduce the migration into the urban sector and even bring back many villagers who help the village for better lifestyle, if technology is brought into each and every region of the village, it can help to provide electricity to each and every household, the education system will change and students will develop computer skills, many of the health issues with end with proper sanitation and construction of toilets followed by smart farming. India is adopting smart farming methods to increase productivity and efficient management of resources. Energy security is fundamental to smart village, the concept of Smart village was brought in **2016 b**y a collaborative work of the Union Ministry of Rural development and Prime Minister of Modi. It is known as the Shyama Prasad Mukherjee Rurban Mission. The aim is to make the village, economically, physically and socially sustainable. At present 300 villages have being targeted to bring smart solutions, States like Telangana, Andhra Pradesh, Maharashtra, Rajasthan have soon interest in smart village development, it is project is being down through public-private partnership. Smart refers to the creation of micro, nano and mini grids within energy eco system of a village, Electrification is the key to smart village, use of green technology in rural India. Two of the smart villages have been Chhotkei in Odisha and Uttar Pradesh has Paniyara. Paniyara was made smart with Re New Power CSR with focus on energy security in the region. The CSR has been working on the development of smart villages and its major programme includes -Creation of community based solar micro -grids, supplying electricity to household, Aanganwadi and schools. Formation of ReNew Edu Hub an education centre where learning will be done through technology and digital literacy will be enhanced in the villages. Stimulation of rural sports under ReNew scholarships, Training and knowledge centre for farmers and access to safe drinking water, RO units in the villages, schools and Aaganwadi centres. We have seen many smart villages emerging we have examples in Rajasthan, West Bengal, Gujarat and so on. This concept smart village will reduce the urban rural gap and bring positive change in the society, the thinking process will become liberal and progressive in the country which will also end social stigma, orthodox mentality, people will come out of traditional ways of living and adopt to modern technology which will maintain a balance with nature. India economy with enhance and population will also reduce. Smart education, smart agriculture, smart health care system, smart villages, smart use of energy, smart urban mobility, but with better infrastructure for cyber and creating infrastructure for the use of technology to the village, where 4G is accessible, creation of towers in the villages connecting the region with Wi-Fi service

IV. RESEARCH METHODOLOGY:

Research Design

This study employs a mixed-methods research design, combining quantitative and qualitative data collection to explore the impact of digital education and skills development on rural growth. The research is both descriptive and exploratory, aiming to provide insights into current conditions and propose actionable recommendations.

Data Collection Methods

1. Survey Questionnaire

A structured Google Form survey was designed to gather quantitative data from respondents. The questionnaire consisted of multiple-choice, Likert scale, and open-ended questions to collect diverse perspectives. The survey targeted rural community members, educators, and stakeholders involved in digital education and skill development programs. **Sample Size: Responses were collected from 105 participants.**

Respondent Demographics: The participants included individuals from various age groups, educational backgrounds, and professional roles within rural areas.

Primary data :

We have collected primary data from Google Forms to gain insights directly from respondents for our study. This method allowed us to gather first-hand information by designing a questionnaire tailored to our research objectives. The data includes responses on various parameters relevant to the project, ensuring a diverse and accurate representation of the target group. This approach not only enhances the reliability of our findings but also provides valuable perspectives to analyze trends and patterns effectively.

Secondary Data

Articles and reports related to digital education, skills development, and rural growth were reviewed to complement the primary data. These secondary sources provided context and supported the interpretation of survey findings.

Sampling Technique

A non-probability purposive sampling method was employed, selecting participants who were directly or indirectly involved in rural education and skill development. The criteria ensured that the data collected was relevant and aligned with the study objectives.

1. Quantitative Analysis

- Descriptive statistics (e.g., frequencies, percentages, and averages) were calculated to summarize responses.
- Likert scale responses were analyzed to gauge perceptions and satisfaction levels regarding digital education and skills programs.

2. Qualitative Analysis

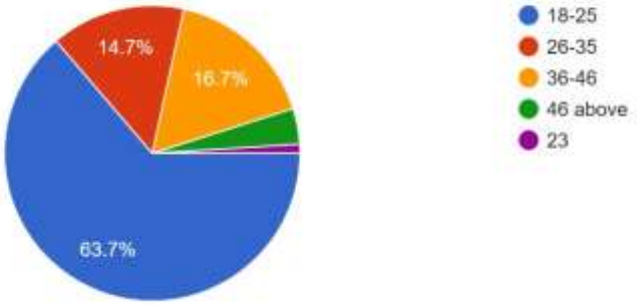
o Open-ended responses from the survey were subjected to thematic analysis to identify recurring themes, challenges, and opportunities. o Insights from articles were synthesized to contextualize the findings and align them with broader trend

V. DATA ANALYSIS AND INTERPRETATION

The survey results provide valuable insights into age distribution, skill preferences, and digital education in rural areas. Among 102 respondents, the majority (63.7%) are aged 18-25, followed by 16.7% aged 26-35 and 14.7% aged 36-46, with a small fraction above 46. A minor anomaly in the data, labeled “23,” requires clarification. Regarding skill development programs (104 responses), agricultural skills are the most preferred (38.5%), followed by digital literacy (26.9%), while vocational and entrepreneurial skills each account for 12.5%, and soft skills rank lowest at 9.6%. On the importance of digital education for rural growth (105 responses), 37.1% rate it as “important,” 26.7% as “very important,” 20% as “somewhat important,” while 13.3% find it “not important,” and 2.9% are “unsure.” Barriers to digital education in villages include the lack of digital devices (43.8%) and internet connectivity (25.7%) as the most significant, followed by high costs (15.2%), lack of digital literacy (10.5%), and minimal interest (4.8%). These findings highlight a need to address infrastructure gaps and prioritize programs that align with the preferences and challenges of rural communities.

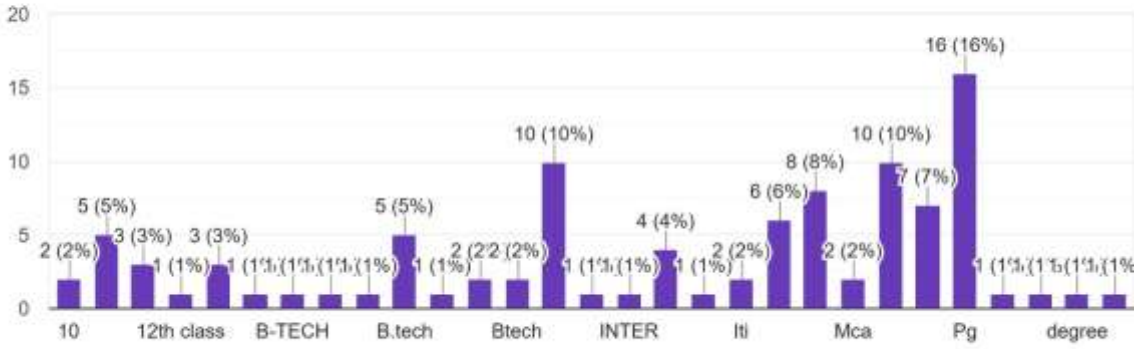
AGE

102 responses



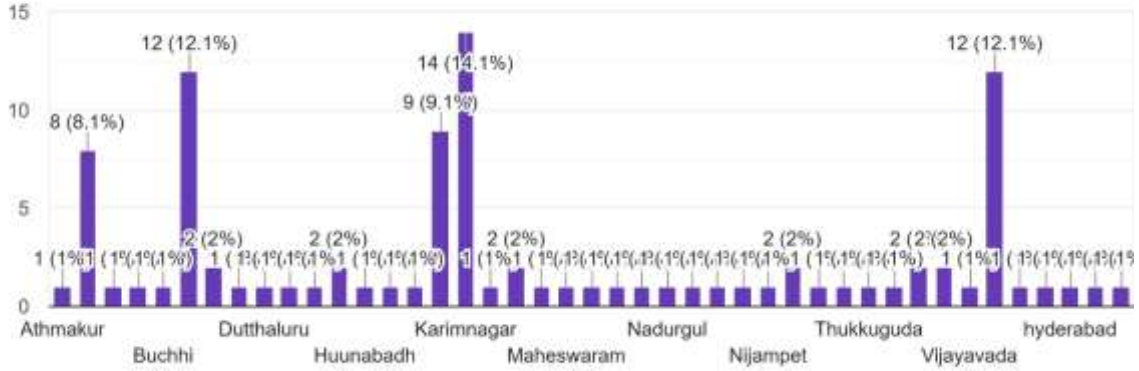
What is your highest level of education?

100 responses



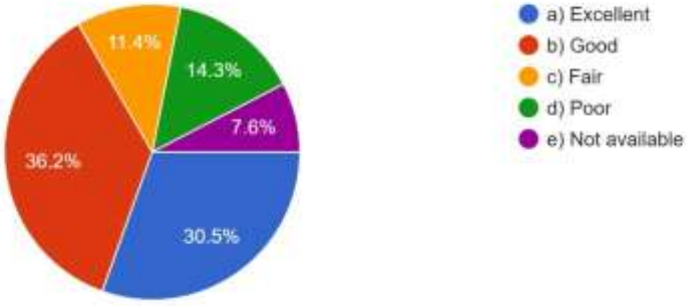
Where do you live?

99 responses



How would you rate the availability of digital education resources (e.g., online courses, e-books) in your rural area?

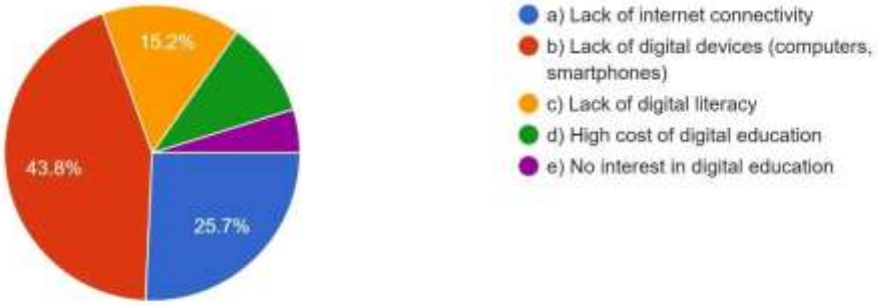
105 responses



The survey had 102 respondents, with the majority (63.7%) aged 18-25, followed by 26-35 (16.7%) and 36-46 (14.7%). A small fraction is above 46. The data is dominated by younger participants, reflecting their higher engagement. An unclear category, "23," may need clarification or correction.

What is the primary barrier preventing access to digital education in your village?

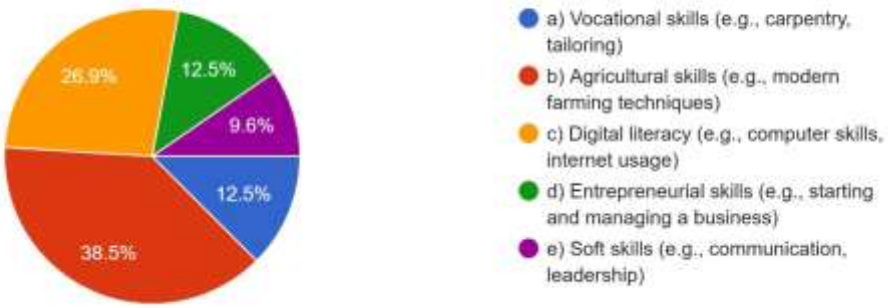
105 responses



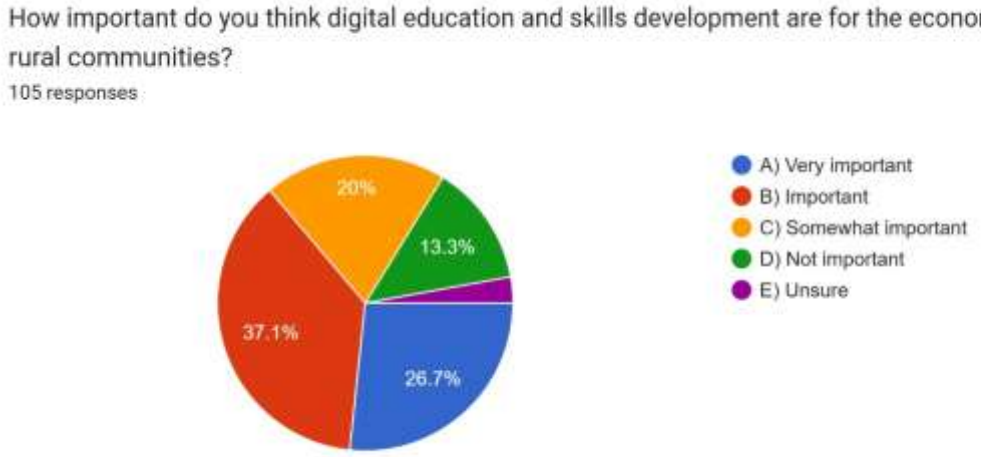
The chart highlights barriers to digital education access in villages (105 responses). The most significant obstacle is the lack of digital devices (43.8%), followed by lack of internet connectivity (25.7%). High costs (15.2%) and lack of digital literacy (10.5%) are less common, while only 4.8% cite no interest in digital education.

Which type of skill development programs would benefit you the most?

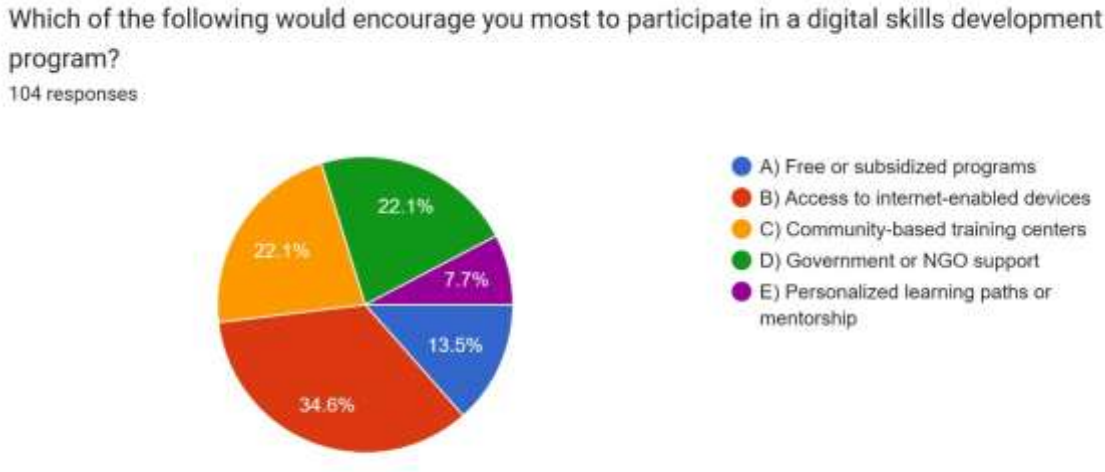
104 responses



Out of 104 responses, **38.5%** preferred agricultural skills, followed by **26.9%** favoring digital literacy. Vocational and entrepreneurial skills each received **12.5%**, while **9.6%** prioritized soft skills. The results highlight a strong interest in modern farming techniques and digital skills, with lesser demand for practical trades and communication development.



The chart illustrates opinions on the importance of digital education and skills development for rural economic growth (105 responses). A majority (37.1%) consider it "important," followed by 26.7% who deem it "very important." "Somewhat important" accounts for 20%, while
13.3% say "not important," and 2.9% are "unsure."



The survey highlights that 34.6% of respondents prioritize free or subsidized programs to join digital skills development. Community-based training centers and personalized learning paths follow, each preferred by 22.1%. Government/NGO support appeals to 13.5%, while only 7.7% value access to devices. This indicates a strong need for affordability and localized, tailored learning opportunities in fostering participation, while access to devices is less of a concern for most participants.

INTERPRETATION:

The survey highlights key insights into age demographics, skill preferences, and rural digital education. The majority of participants are aged 18-25, reflecting higher engagement from younger demographics. Among skill development programs, agricultural skills lead, followed by digital literacy, indicating the relevance of farming and technological education in rural communities. Vocational, entrepreneurial, and soft skills are less prioritized, suggesting a focus on practical and technical development over interpersonal skill-building. The importance of digital education for rural growth is widely recognized, with most respondents considering it either “important” or “very important.” However, significant barriers persist, such as a lack of digital devices and internet connectivity, which overshadow cost and literacy challenges. This analysis emphasizes the urgent need to address infrastructure gaps and promote affordable, accessible digital education solutions to empower rural communities. Bridging these gaps will not only improve skill development but also contribute to sustainable rural economic growth by aligning resources with the community's preferences and challenges. The findings also suggest targeting youth as key beneficiaries, given their higher engagement, to maximize the impact of initiatives.

VI. FINDINGS:

- The survey had 102 respondents, with the majority (63.7%) aged 18-25, followed by 26-35 (16.7%) and 36-46 (14.7%), while a small fraction is above 46.
- An unclear category labeled "23" may need clarification or correction.
- Out of 104 responses, 38.5% preferred agricultural skills, followed by 26.9% favoring digital literacy.
- Vocational and entrepreneurial skills each received 12.5%, while 9.6% prioritized soft skills.
- The results indicate strong interest in modern farming techniques and digital skills, with lesser demand for practical trades and communication development.
- Among 105 responses, 37.1% consider digital education "important" for rural economic growth, followed by 26.7% who deem it "very important."
- 20% view it as "somewhat important," 13.3% see it as "not important," and 2.9% are "unsure."
- The primary barrier to digital education access is the lack of digital devices (43.8%), followed by lack of internet connectivity (25.7%).
- High costs (15.2%) and lack of digital literacy (10.5%) are less common barriers, while 4.8% cite no interest in digital education.

Suggestions

- Address the lack of digital devices by introducing affordable or subsidized programs for rural areas.
- Expand internet connectivity infrastructure to improve accessibility in remote villages.
- Conduct community workshops to enhance digital literacy and foster awareness of its importance.
- Introduce low-cost digital education options to tackle affordability issues.
- Focus on agricultural and digital skill development programs to meet the highest demand among respondents.
- Offer blended programs that combine practical trades with communication and leadership training to address overlooked areas like soft skills.

- Engage younger participants actively, as they show higher interest and involvement, while tailoring strategies for older demographics.
- Clarify and rectify ambiguous data categories like "23" to ensure accurate interpretation and reporting.

VIII. CONCLUSION:

The study on Smart Villages: Digital Education and Skills Development for Rural Growth underscores the transformative potential of digital education and vocational training in empowering rural communities. The findings reveal that a majority of respondents recognize the value of digital tools in expanding learning opportunities and improving educational quality. Vocational training, in particular, is seen as a crucial factor in enhancing employability and fostering entrepreneurship, which can drive economic growth in rural areas.

However, the study also highlights significant barriers, including inadequate internet connectivity and high costs, which limit the reach and effectiveness of digital education. These challenges underline the urgent need for infrastructure development and affordable digital solutions tailored to rural contexts. Furthermore, government intervention, policy reforms, and public-private partnerships are essential to bridge the digital divide and ensure equitable access to education and skills training.

The findings also emphasize the importance of fostering digital literacy among rural populations, empowering them to leverage technology for their personal and professional growth. By addressing these challenges, digital education and skills development can play a pivotal role in transforming rural communities into self-sustaining ecosystems. Overall, the study affirms that strategic investments in digital infrastructure and education can unlock the untapped potential of rural areas, fostering long-term growth and development.

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