

Using Skill Chatbot to address India's skill shortage and unemployment

(word limit 3993 excluding title, abstract, authorship, bibliography and footnotes)

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Abstract

India has a paradox of skilling where an acute shortage of skilled workforce, as well as high levels of unemployment, exists together. To address this and to ensure that India reaps the benefits of demographic dividend, it is critical to skill its youth population. Affordability and accessibility of avenues for skilling is still a challenge for uneducated and unqualified youth. They also require platforms for skilling that facilitate learning at their own pace and time, local language instruction, usage of multimedia formats to retain attention and minimal entry-level requirements.

In addition to the unemployed youth, India's artisans and rural entrepreneurs would also benefit from the skilling on digital literacy, financial literacy, digital financial literacy, citizen services and data management. As per a baseline study undertaken by Digital Empowerment Foundation (DEF) and Commonwealth of Learning (COL), even when the artisans, weavers and rural entrepreneurs possess smartphones and access the internet, using smartphones to acquire new skills and conduct business is minimal. The majority of the respondents expressed interest in training in online commerce, social media marketing and online data management. It is in this context that Skill Bot becomes relevant.

Skillbot is a self-learning chatbot built on the Telegram platform. Telegram is a free, open-source and accessible messaging service. Unlike WhatsApp, which offers paid chatbot features, Telegram chatbots are completely free as well making them accessible to organizations.

Skillbot was developed by DEF and Commonwealth of Learning to teach digital literacy, financial literacy, citizen services and data management. Skillbot is multilingual and employs tutorial lessons, audio graphics, infographics, flashcards, interactive quizzes and activities for teaching. Since both Telegram and Skill Bot is free, easy to use and accessible, this provides a platform for those without access to formal avenues of learning to acquire the skillsets. Using the Skillbot requires basic digital literacy only. Additionally, since it is interactive with continuous assessment, learners can proceed at their own pace. So far, 2400 users have been accessing it.

From an organizational point of view also, Skillbot is a valuable tool. Covid-19 pandemic has restricted the ability of organizations to reach out to learners. Skillbot provides the opportunity to deliver content to a large demographic at a minimal cost. Organizations find it costly to build, manage, promote and maintain mobile applications or web-based learning management systems. Telegram also provides back end technical support, further reducing cost and labor.

Keywords: Self-Learning, Mobile-based learning, Skill Development, Skill Chatbot

Introduction

India, a developing country that has long suffered from a shortage of skilled labour, is also witnessing high levels of unemployment. This poses a severe threat to the demographic dividend of the country as between 2020-50, India is expected to add another 183 million people to the working-age group of 15-64 years, without enough jobs and required skill sets.¹ Consequently, there is a need to move away from a supply-based to a demand-based skill system with an emphasis on skilling India's youth population. Moreover, the rapid transformation towards a digital economy further requires enhancing the digital financial skills of this youth

¹PTI. (2022, 5 April). Demographic dividend may turn into liability sans enough jobs, skilled workforce: Report. *The Economic Times*. <https://economictimes.indiatimes.com/jobs/demographic-dividend-may-turn-into-liability-sans-enough-jobs-skilled-workforce-report/articleshow/90622910.cms>

population to be able to use digital tools, platforms, linkages and access digital financial resources, in order to boost employment, entrepreneurial ventures and digital capital gains.

More than 60% of India's workforce lives in rural, semi-rural and small towns. This population is technologically adept which opens up a plethora of technologically innovative solutions to be harnessed to address the problem of lack of digital financial skills. In this context, Digital Empowerment Foundation (DEF) and Commonwealth of Learning (COL) have developed Skillbot- a self-learning Learning Management System (LMS) Chatbot- on the freeware, cross-platform and cloud-based instant messaging service 'Telegram'. This is towards '*Digital Skilling through Blended Learning Approach for Entrepreneurship and Livelihood*' of rural youths, artisans and entrepreneurs across multiple States in the country. Telegram is open-sourced and end-to-end encrypted and, Telegram chatbots are completely free, making them accessible to organizations.

The purpose of Skillbot is to facilitate digital financial literacy, citizen services, and data management. Skillbot is multilingual and employs tutorial lessons, audio-graphics, info-graphics, flashcards, interactive quizzes, and teaching activities. Since both Telegram and Skillbot are free and easy-to-use, this provides a platform for those without access to formal avenues of learning to acquire the skillsets. Using the Skillbot requires basic digital literacy only.

The Skillbot is a democratic, inclusive, open, remote, personalized, and customized learning service. It's a step towards transcending the socio-economic gaps in how education is available to different socially marginalized groups. Consequently, by addressing the various systemic biases and power imbalances in terms of access to digital and financial resources, information and formal education for such groups, DEF and COL is attempting to overcome the plaguing skill divide in digital financial literacy. From an organization's point of view, the Skillbot is extremely cost-effective, efficient, flexible, safe, secure, and generates interactive learning which is suitable for those who are illiterate or semi-literate. Moreover, the mobile mediated mode of open-learning is another step towards realising the Sustainable Development Goal (SDG) 4 which aims to ensure equitable and quality education for everyone regardless of their gender, caste, race, sexuality, tribe, religion and disability.

I. Literature Review

The Skillbot is an A.I.-based learning management system (LMS) Chatbot on Telegram for mobile learning or M-Learning within an open-learning pedagogical framework. While there is adequate literature on open-learning, work on m-learning and Chatbot for learning is still nascent. The following literature review will map these works in order to provide a background to the purpose and piloting of the Skillbot by DEF and COL.

1. Open-Learning

Open-learning is often interchangeably used with distance-learning or e-learning. Many literatures have dealt with the subject of open-learning. These works usually focus on systems, theories, management, organization, technology, teaching, and learning issues (Caliskan, 2012). However, there is much contestation regarding the definite meaning of open-learning and what it entails. Roger Lewis (1990) in his review of Phil Race's 1989 book '*The Open Learning Handbook: Selecting, Designing, and Supporting Open Learning Material*', discusses the varied perspectives on open-learning. Some believe that open-learning is an alternative mode of education for those who are unable to get conventional education because of time and space constraints. Others however argue that open-learning is more than just convenience. Learners do not only have the freedom to choose the best time and place to learn but also choose what and how to learn. In this way, learners are empowered to take control of their own learning in relation to the curriculum, methods and other processes that are used.

Williams (1996) has propounded descriptive, prescriptive and explanatory theories of open-learning. According to the descriptive theory, open-learning is a system of teaching and delivery that employs advanced communication technologies and design considerations. It makes the learning process more flexible, accessible, and learner-centred. Consequently, the system of open-learning concentrates on removing barriers to participation that learners may encounter by incorporating a quite wide range of independent and individualized teaching and learning strategies. According to the prescriptive theory, learning is seen as being an approach to meet a need or philosophy. The explanatory theory on the other hand examines the events and processes in relations to their surrounding factors such as technological, economical, and political developments. Open-learning is an umbrella concept embraces and contains distance-learning, resource-based learning, correspondence courses, self-paced learning, student-centred learning, and flexible learning (Kember & Murphy, 1990).

2. M-Learning

Rapid technological development and its integration in the various sectors of society are changing the scope and pace of productivity. The changing architecture of the education system and learning is also adapting to such developments. Open-learning pedagogies have been able to well utilise the developments in information and communication technologies (ICTs). With easy and affordable availability of smartphones and other portable devices which can be linked to wireless internet at any place and time, M-learning is increasingly being employed, especially for open-learning. Yousuf (2007) defines M-learning as provision of education and training on mobile devices which citizens carry everywhere with them, which they regard as friendly and personal devices, that are cheap and easy to use. Similarly, Goksu & Atici (2013) define M-learning as a type of learning that takes place through portable devices which enables its users to meet their needs within seconds in terms of accessing ever-changing data and communicating with others.

Biden & Ziden (2013) has broadly classified the factors that are influencing m-learning in education. These factors are: features of the device, user's expectations and pedagogical advantage. The features depend on the device's convenient usability and functionality in terms of access, spontaneity and portability. User's expectations are driven by ownership of the device (Attewell & Webster, 2005), privacy, self-regulated learning, flexible learning and fun in terms of usage of games for the purpose of learning (Prensky, 2007). Pedagogical advantages include the experience of collaborative-learning (Uzunboylu et al, 2009), blended-learning, interactive-learning, experiential-learning and problem-based learning. Moreover, according to Kelly (2019), m-learning allows reflective practices and engenders relevancy and transferability of learning to wider contexts outside of the classroom. M-learning in the context of marginalised groups can therefore create a space that is capable of generating inclusive practices that combat hegemony and promotes more democratic power relationships (Kelly, 2020).

3. Chatbot for Learning

In recent times, Chatbot technologies are used to facilitate m-learning through integration of pedagogic approaches with innovative technologies. A Chatbot is a software (machine) that is able to talk to a user (human). However, the emulation of human dialogue is a difficult task and involves problems related to '*Natural Language Processing*' (Yan et al, 2015). Most literatures on Chatbot have focused on the correct design for the conversation flow. These works are based on the knowledge-base of the domain, which can be used to interpret the intentions of the user and solve the problem of interpretation of sentences written by the user (Lin et al, 2016). According to Colace et al. (2018) Chatbot creates an interactive learning experience for the students, like the one-to-one interaction with the teacher. By testing the student's behaviour and keeping track of their improvements, bots play an essential role in enhancing the skills of an individual student. Moreover, they can serve a major role in encouraging a student to work by sending regular reminders and notifications. Moreover, Chatbot can adapt to the speed at which a student can learn without being too pushy.

Various forms of Chatbots have been experimentally used for e-learning to-date. For instance, Niranjana et al. (2012) propound an interesting approach using Bayesian theory to match the request of students and furnish the right response. Here, Chatbot agent accepts the student's answers and extracts the keywords from the question using a lexical parser. Then the keywords are compared with the category list database. The Bayesian probabilities are obtained for all categories in the list. Once the category is selected, keywords are compared with the questions under the category using Bayesian probability theory. The answer to the question, which has the highest posterior probability, is then fed into the text to speech conversion module and thus, the student receives the answer to their question as a voice response. In another case, Nordhaug et al. (2015) proposed a game based e-Learning tool called '*The Forensic Challenger*' which is used to teach digital forensic investigation. A multiple-choice question-based quiz is implemented for kinaesthetic learners, and easy navigation and interaction within the content are provided. The Chatbot is implemented to be a pedagogical agent for the users, meant for discussions and help with the topics. It also acts as a navigation tool and can play video or use the advanced wiki.

However, while most of the studies on Chatbot for learning deal with the technology itself, there is an acute dearth of its implications in the actual lives of the students/users. This paper is an attempt to fill that gap whereby Chatbot technology's usage for inculcating digital financial skills in the users through m-learning and open-learning will be discussed through the results of a survey and interview of the users of Skillbot as conducted by DEF and COL.

II. Research Methodology

The Skillbot project seeks to improve the livelihoods of rural weavers/artisans and micro-entrepreneurs, both men and women by facilitating m-learning and open-learning towards inculcating digital financial skills. The

project entails the development and running of a Telegram embedded LMS Chatbot platform known as Skillbot, for participants to access skill and training resources and support, formation and management of Telegram groups of participants, and use Quizbot features. Trainers are trained online using the same platform. Existing educational resources were reviewed in order to develop a fresh training outline using digital assets for a 30 hours course (Digital assets: visuals, videos, audios, flowcharts, flashcards, quizzes, participatory/group activities, and games). These new learning materials were translated into six additional languages, besides English: Bengali, Hindi, Marathi, Odia, Kannada, and Telugu.

Baseline surveys were used to map the socio-economic background of the weavers, artisans and entrepreneurs; their existing business and marketing strategies; and ICT uses and practices. The survey also gave an overall idea of the target groups so as to ensure smooth training sessions. Consequently, 2400 participants were identified from 12 Indian states - Andhra Pradesh, Bihar, Haryana, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Telangana, Uttar Pradesh and West Bengal. They were divided into groups of 12 cohorts (Telegram groups) and trained for a period of over 2 months through Skillbot platform.

A pilot evaluation was conducted from the last week of February 2022 to the first week of March 2022 to: 1) measure the effectiveness and viability of the ‘digital skilling through blended learning for entrepreneurship and livelihood’ for targeted participant groups; 2) measure the Social Rate of Investment (SROI) from the project including improvement of livelihood for the project participants.

Sample size for the pilot evaluation was 200 of the total number of 2400 participants. This was equally distributed amongst the States/languages covered, and 30-50% was kept as the range for respondents to be selected from different gender, caste, and community.

The randomly selected participants belonged to all genders (men/women/trans) across 12 states and to all castes and communities (General/Scheduled Caste/Scheduled Tribe/Other Backward Caste/Minority Groups). The participants are artisans/weavers/ entrepreneurs. Within artisans, they are master artisans/artisans working with master artisans/others. Within weavers, they are handloom entrepreneurs/master weaver/nakshaband/grapher/weaver working with master weaver/weaving cooperative or society members/others. Within entrepreneurs, they are beauticians/common services centres/dairy shops/ garments making and selling/medical stores/fish farming/poultry and livestock/SoochnaSevaKendras/ vermin-culture/sellers of minor non-timber forest produce/sericulture/beekeeping/shopkeepers/Micro-businesses (like pickles, papads)/stationery shops/sweet and confectionary shops/tailoring/ others.

Percentage of demographic make-up of participants:

- **Gender:** 53% women, 46.5% men and 0.5% non-binary.
- **Religion:** 83.5% Hindus, 14.5% Muslim, and 2% Christians.
- **Caste:** 33.5% OBC, 29.5% SC, 24.5% ST, and 12.5% General caste.
- **Educational Qualification:** 28% secondary school (9 to 10), 22% senior secondary school (9 to 12), and 18% graduates.
- **Income:** 70.5% below the poverty line; 29.5% above the poverty line.
- **Occupation:** 74% entrepreneurs, 8.5% artisans, and 17% weavers.

The evaluation was done using both the primary and secondary input methods along with deductive and inductive derivations of evaluating the key project parameters/indicators which are: (i) Curriculum Content, (ii) Method and Platform of Delivery including Training of Trainers, (iii) Output; (iv) Outcome. These 4 indicators have further parameters under them as shown in the following table:

S. No.	Primary Indicators	Sub Indicators
1.	Curriculum Content	<ul style="list-style-type: none"> •Secondary assessment of Content Need Assessment. •Primary first-hand assessment by evaluators of content; Inputs from trainers; inputs from participants; •Qualitative & Quantitative assessment; primary tools/instruments of evaluation.
2.	Platform of Content Delivery for training	<ul style="list-style-type: none"> •Primary first-hand assessment by evaluators of Telegram, Chatbot LMS in content placing, delivery, learning assessment; •Primary inputs from trainers; inputs from participants; inputs from managers; •Exploratory / Deductive / Inductive in exploring the platforms

		and features at various levels from users, management; learning assessment point of view for MBLs purpose Primary tools of evaluation
3.	Output	<ul style="list-style-type: none"> •Secondary inputs based on LMS data and reports; reference to data from baseline, mid-line-end line; •Primary inputs from participants across variables •Quantitative: Data & Analysis based on numbers of participants reached out across social, economic, variables. •Qualitative evaluation based on interviews, discussions (online /offline) •Primary tools including administering questionnaire / tele-interview / Telegram based inputs and feedback •Random sampling with fixed variables - State, District, Participant classification groups
4.	Outcome	<ul style="list-style-type: none"> •Primary: Based on direct reference to data from baseline, mid-line-end line; participant inputs •Quantitative evaluation of data & Analysis based on numbers of participants reached out across variables. •Qualitative assessment based on primary inputs •Participative tools and direct engagement method - calls, interviews, discussions •Secondary inputs from data and reports of Chatbot LMS. •Social Rate of Investment (SROI) based outcomes.

The indicators were measured using a Likert Scale in the range of 5-1 where 5 = excellent, 4 = good, 3 = average, 2 = fair, 1 = poor. Here,

- **Excellent:** More than 90% and all best possible parameters, factors, needs, reasons were factored in.
- **Good:** More than 70% and satisfactory level of evaluation parameters met.
- **Average:** 50% or less, and more than 40% of all possible and required parameters taken into consideration.
- **Fair:** less than 30% of all possible parameters and factors were factored in.
- **Poor:** Only less than 20% of all possible parameters and factors factored in.

This methodology was applied to all other parameters except Output evaluation which was based on a quantitative assessment. The ranged 5 Likert Scale used here is 5 = Very High, 4 = High, 3 = Medium, 2 = Low, 1 = Very Low. Here,

- **Very High:** 80-100% of the population.
- **High:** 60-80% of the population.
- **Medium:** 40-60% of the population.
- **Low:** 20-40% of the population.
- **Very Low:** Less than 20% of the population

III. Result Overview

Before the project, only about 25% of the participants had heard about or used Telegram. The rest were introduced to the app by the trainers. Interview with both the participants and trainers reveal a change in outlook and willingness to participate in the project. Largely participants were reluctant to partake in the project because they felt that it would be a waste of their time; it holds no value. During the pandemic many people experienced livelihood destruction which created a rather pessimistic outlook towards new opportunities. Consequently, the trainers engaged in detailed conversations with them, explaining them about the project, telegram and Skillbot. Considerable amount of time was spent on building trust between the trainers and the participants. Once the participants got accustomed to the Skillbot interface and the training process, their engagement in the project became more frequent.

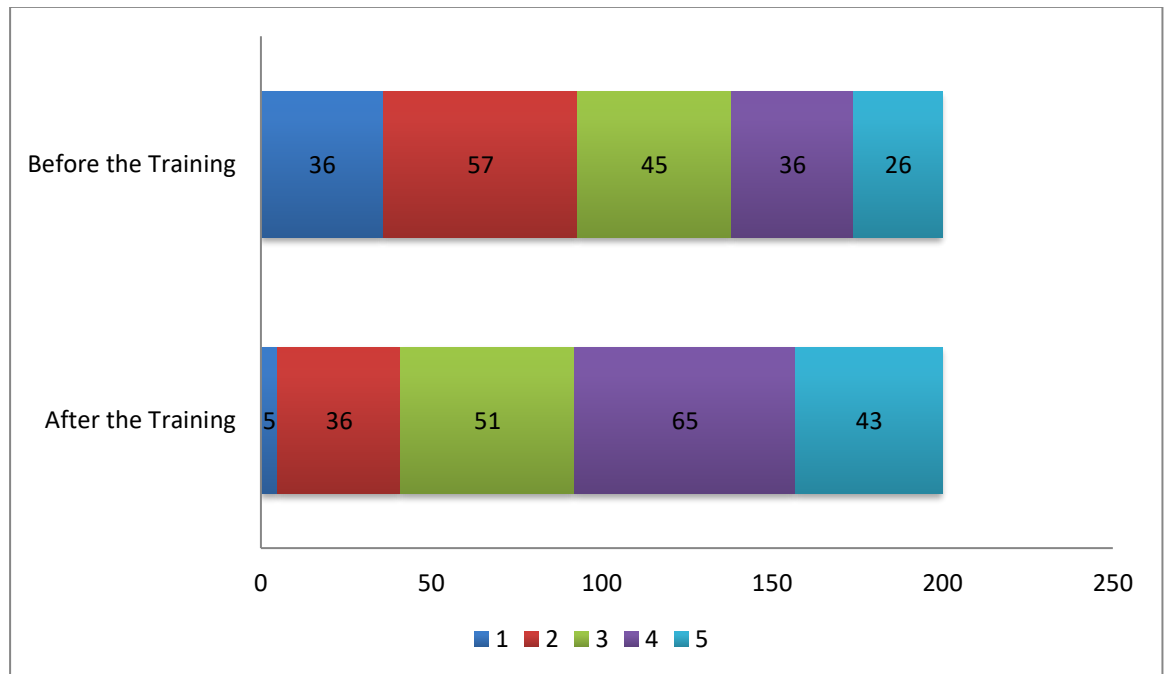
During the pilot, it was found that participants largely struggled with the modules on digital promotion and marketing. To address this problem, video contents were introduced which made the learning process more engaging and interactive. Participants reported getting highly motivated by certain aspects of the interface

design. For instance, after each correct answer, there would be a change in the interface to a cheery and celebratory design with balloons. The project also focuses on community-based learning whereby participants actively engage in regular interaction with each other through telegram groups where they contribute to mutual learning. Apart from the telegram groups, the trainer arrange for a compulsory face-to-face session every week where participants share their experiences, report about their progress and discuss the challenges and issues that they are facing. Once a participant reports having finished all the modules, the trainer would individually check their profile on Skillbot. The community-based mutual learning and the design interface especially contributes to an enriched learning experience and keep the participants motivated to explore new entrepreneurial ventures and expand their existing businesses.

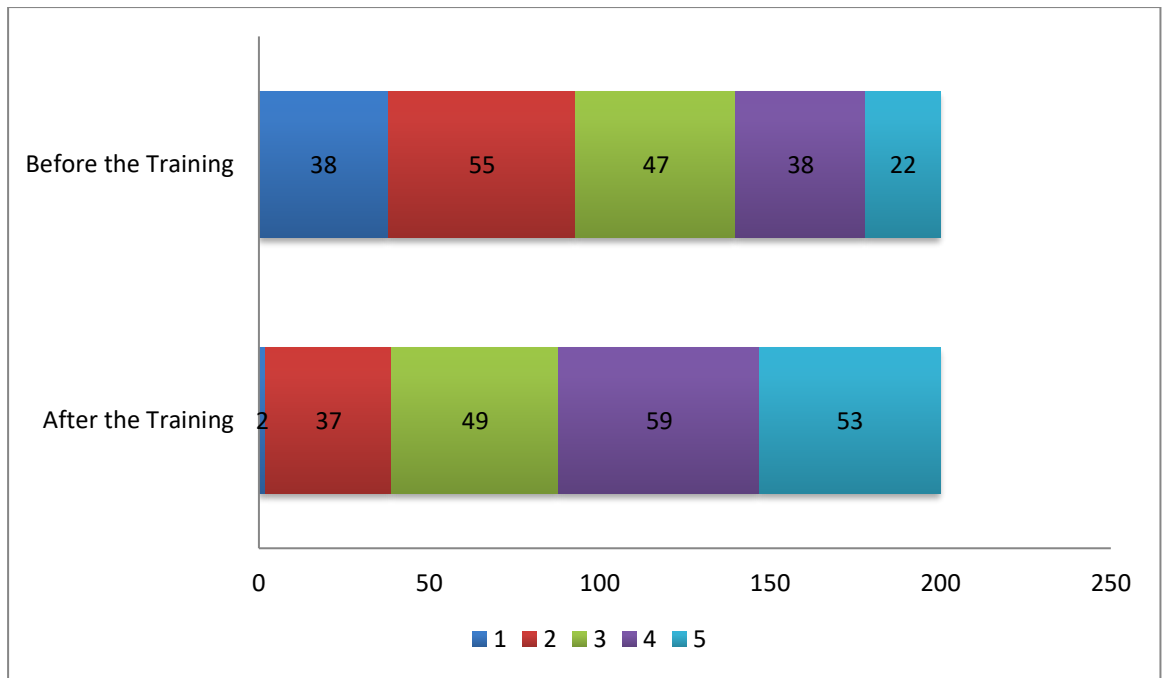
The quantitative data through surveys further explain the results of the outcome evaluation by comparing both before and after the training responses. The results are as follows:

1. Digital understanding of tools and platforms to promote entrepreneurship

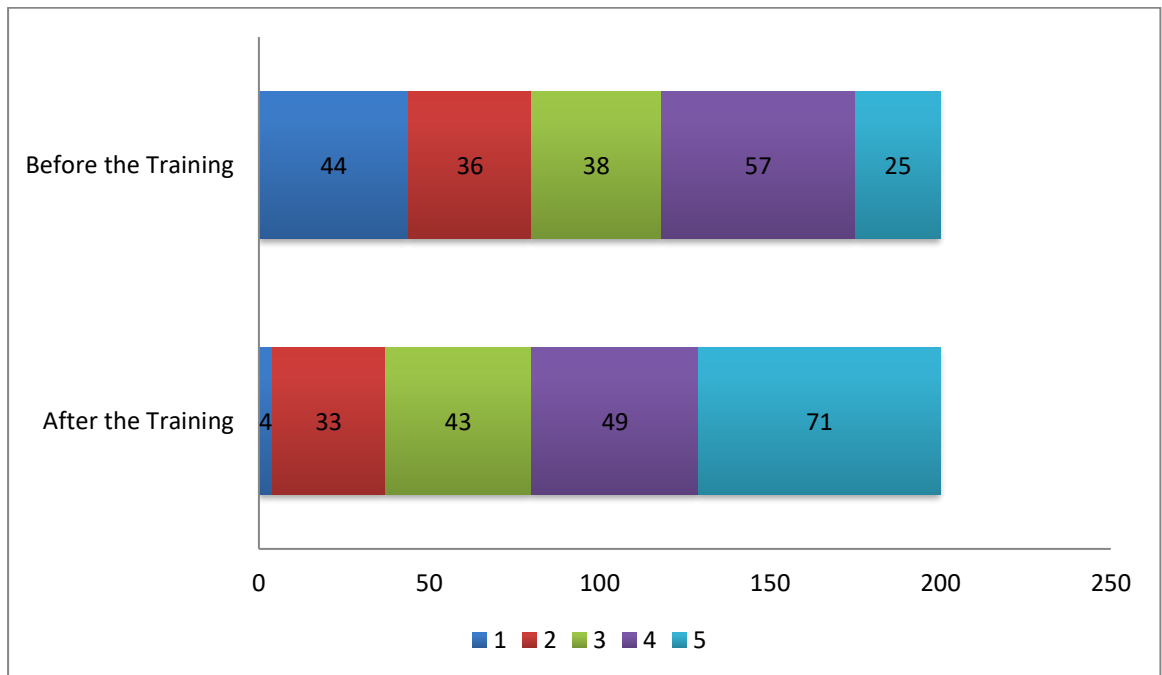
- a. **Usage of devices and mobile phones:** Before the training, 36 out of the 200 (18%) were very poor with devices. After the training, this reduced to 2.5%. Before the training, 26 respondents (13%) said they were very good with the use of devices which increased to 21.5% after the training.



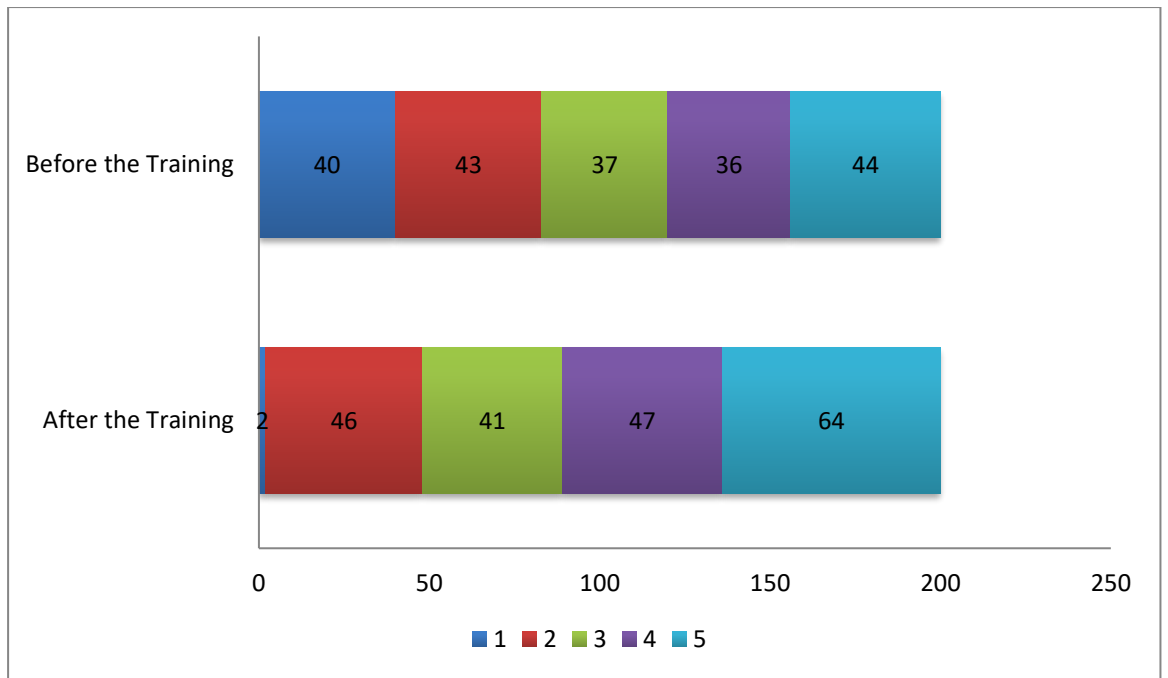
- b. **Usage of social media platforms:** 38 out 200 (19%) of the participants were very poor before the training which reduced to 1% after the training. 11% were very good before the training which improved to 26.5% (53 out of 200) after the training.



c. **Usage of online marketing platforms:** 44 out of 200 (22%) were very poor before the training which reduced to 2% after the training. 12.5% were very good with online marketing platforms before the training which increased to 35.5% after the training.

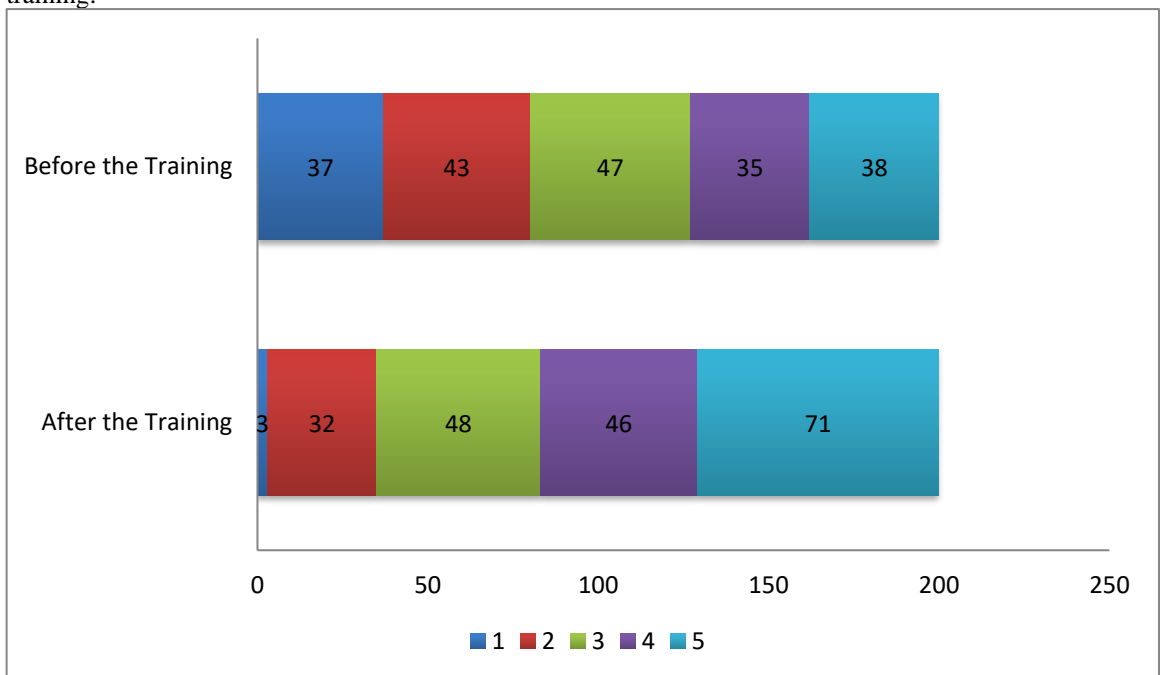


d. **Improvement in digital marketing and promotion:** 40 out of the 200 participants (20%) were very poor before the training which reduced to 1% after the training. Before the training, 22% of the participants were very good at this which improved to 32% after the training.

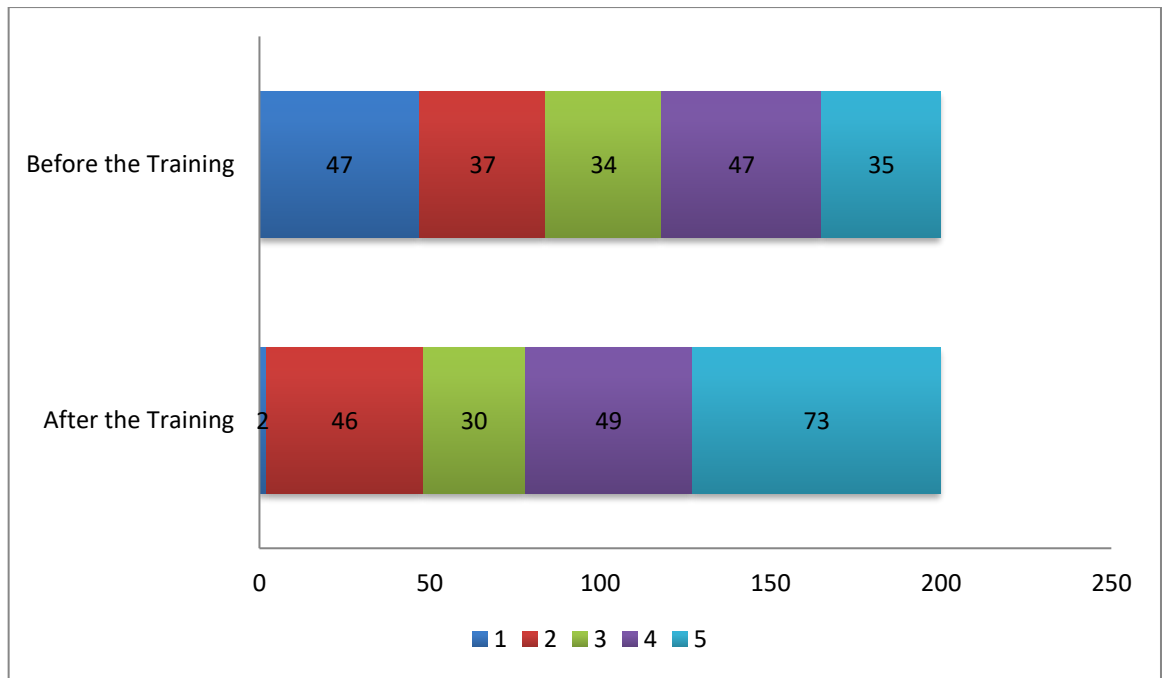


2. Knowledge and Soft Skills Building

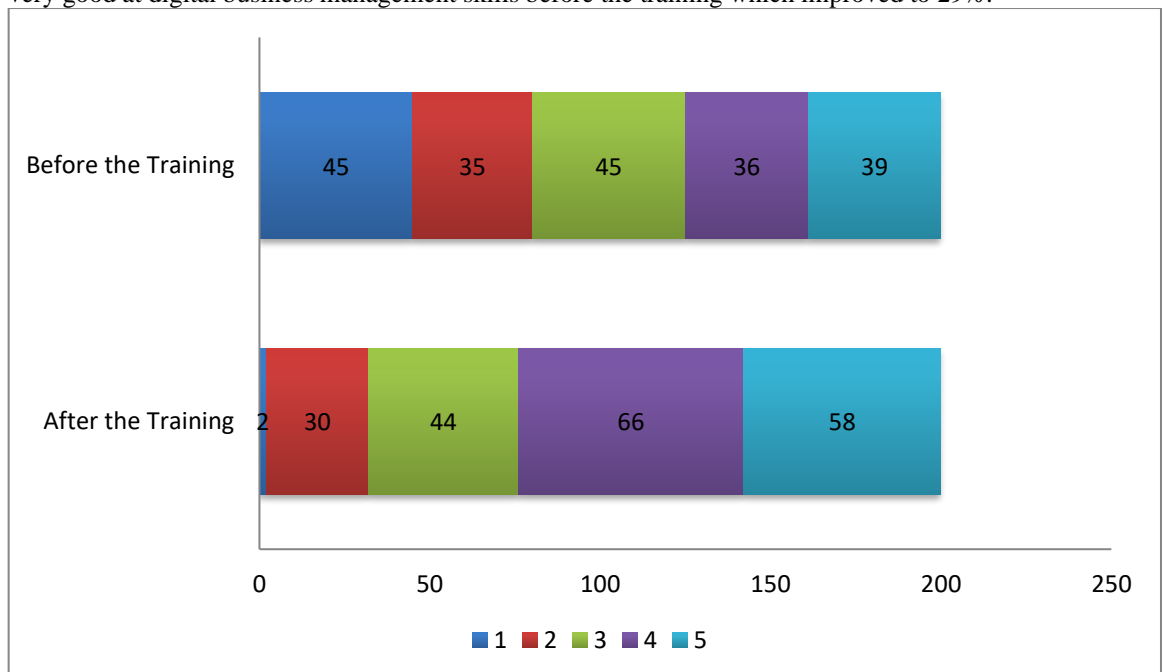
- a. **Confidence in using digital platforms:** Before the training, 37 out of 200 (18.5%) were very poor in terms of confidence in using digital platforms. After the training, this reduced to 1.5%. Before the training, 19% of the participants were very good at it which improved to 35.5% after the training.



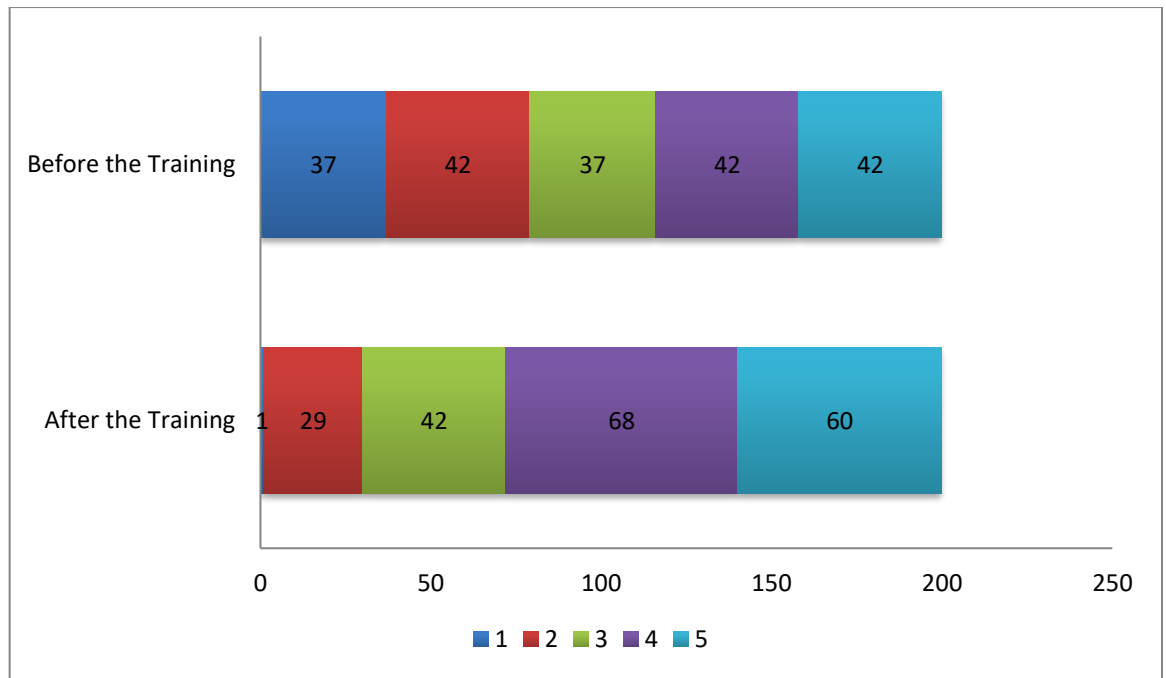
- b. **Changing digital knowledge and exploration:** 47 out of 200 (23.5%) were very poor before the training which reduced to 1% after the training. Before the training, 17.5% were very good at this which increased to 36.5%.



- c. **Changing digital business management skills:** 45 out of 200 (22.5%) were very poor in digital business management skills before the training which reduced to 1% after the training. 19.5% were very good at digital business management skills before the training which improved to 29%.

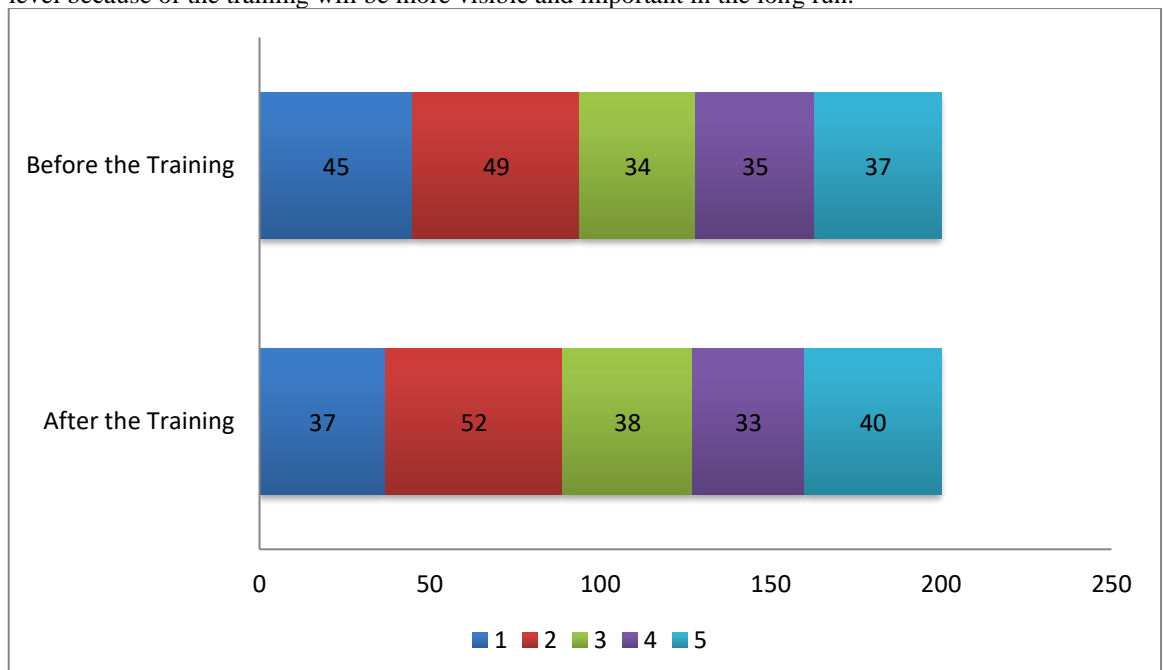


- d. **Changing business and enterprise decision making:** 37 out of 200 (18.5%) were very poor in business and enterprise decision making before the training which reduced to 0.05% after the training. Before the training, 21% of the respondents were very good at this which improved to 30% after the training.

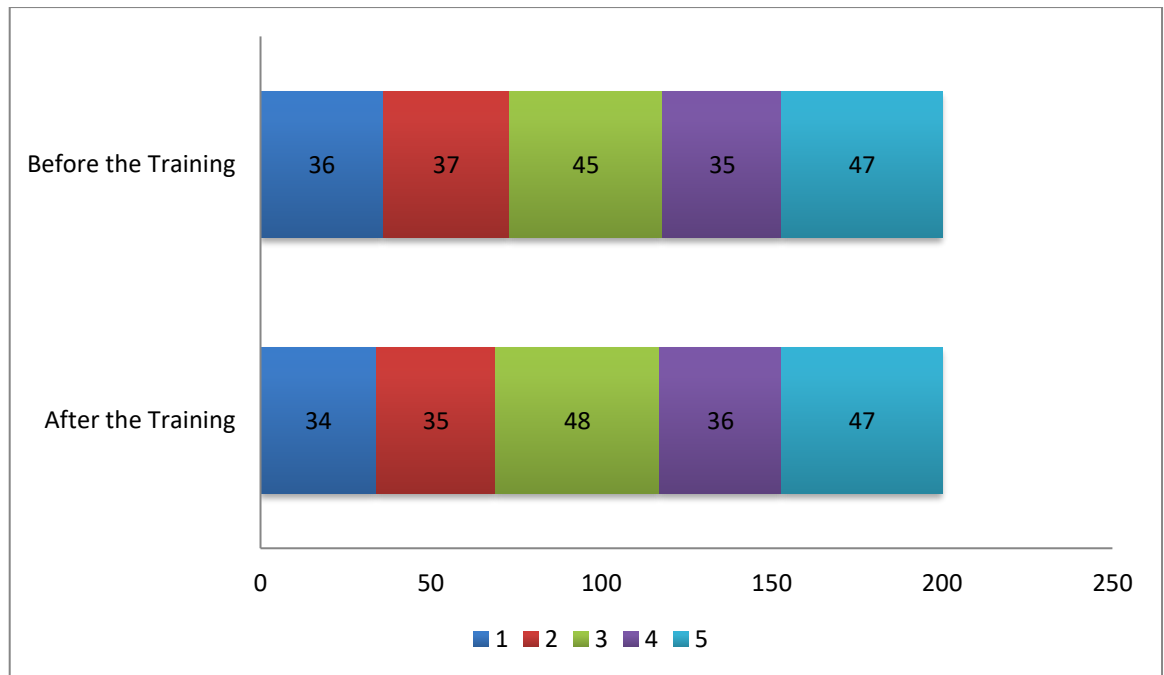


3. Economic and Social gains

- a. **Income level:** Participants were asked about their perception of their income levels before and after the training. Here, a score of 1 represents very unhappily with the income level and 5 represents very happiness. Before the training, 45 out of 200 respondents (22.5%) were very unhappy with their income level which changed mildly to 18.5%. Before the training, 18.5% were very happy with their income level which improved to 20% after the training. Many of the participants are new in their ventures and have started their entrepreneurship in the last year. The change in perception of income level because of the training will be more visible and important in the long run.



- b. **Livelihood Security:** Participants were asked about their perception on their livelihood security before and after the training. Here, again, a score of 1 represents very unhappy with the income level and 5 represents very happy. Before the training, 36 out of 200 respondents (18%) were very unhappy with their income level which changed mildly to 17%. Before the training, 23.5% were very happy with their livelihood security which remained the same after the training.



IV. Discussion

Extensive skill deficit among the large youth population of India, especially in rural areas, is a major cause of concern for the growing imbalance in the demographic dividend of the country. However, there are several reasons for this setback: the size of the youth population, and the hierarchical and segmented nature of both the labor market and society as a whole (Okada, 2012). In India, a tiny fraction of youth population is able to afford good education and training which allows them to get well-paid jobs in the organized sector. Whereas, the large majority of youth from economically and socially disadvantaged groups get very limited access to vocational training. They work in the unorganized sector.

Over 90% of employment in India is in the informal sector sans high productivity jobs. Consequently, provision for skilling is an important intervention to increase the productivity of this workforce. This sector cannot approach the formal system. Therein, open-learning can play an important role by providing flexible and cost effective vocational education (Fozdar & Kumar, 2008).

The Skillbot based project by DEF and COL approaches the problem of skill deficit using innovative technology to impart digital financial skills to rural entrepreneurs, artisans and weavers. The m-learning and open-learning model has presented optimistic results among its 2400 participants in just a few months. There is improvement in terms of their understanding of digital tools and platforms promoting entrepreneurship. More participants are able to utilise social media for digital marketing and promotion of their ventures and products. The training has improved their confidence on the usage of digital tools, resources, platforms and linkages which are necessary components of digital finance for successful entrepreneurship in today's competitive and increasing digital market economy. These changes cut across the varied socio-economic backgrounds of the participants. This model of learning has shown great potential for a sustainable solution to the problem of unequal distribution of access to skill training, especially in the hinterlands of India. Therefore, the m-learning and open-learning model through SkillBot can provide last-mile access to many potential learners.

V. Conclusion

Skillbot has the potential to create sustainable opportunities for many learners regardless of their gender, caste, race, sexuality, tribe, religion and disability. SDG 4 which deals with 'education for all can only be realised if provisions for drastic but quick interventions are created given the looming uncertainty of grave economic destabilisation in the near future. The effects of this are already being borne by the historically marginalised groups. To cope with these economic and social threats, it is important that organizations, institutions and individuals harness the potential of technology for faster, efficient and affordable delivery of the needed

learning required by one to sustain in tomorrow's digital society. While these interventions will prepare India's youth population to join the labour market, policy interventions and drastic structural changes are required to switch from a supply-based to a demand-based skill system. The development of more inclusive technologies which are open-sourced, free, innovative and interactive interface and accessible will further facilitate the creation of an equitable and democratic society that is needed for a sustainable future for all.

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