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Making AI Work in Indian Education

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IT for Change

Preface

"After all, we make ourselves according to the ideas we have of our possibilities."
V.S. Naipaul

There is no doubt that the technological advancement has become the game changer of our times. From the Industry 4.0 discourse launched in Germany in 2011 to the scientific advisory report presented to the former US president Barrack Obama on big data and privacy concerns in 2014, to India's NITI Aayog Artificial Intelligence for All strategy of 2018. A lot of debates have culminated in the questions about the Future of Work in the context of the International Labour Organisation's Centenary in 2019. Triggered by the disruptive forces of technology based start-ups and new business models, a new race for innovations and war for talents has arisen and with it, a new form of global and fierce competition.

Technology has become the holy grail of progress though it did not take long to realise that there is a social dimension attached to it. The platform economy has had severe effects on the bargaining power of suppliers and workers. Data analytics opened a whole array of ethical questions regarding personal tracking and privacy. Further, technological upgrades create productivity gains by efficiency which in turn requires reduced human labour. This poses a particular threat to emerging economies, like India, which need to create new jobs on massive scale for its young and growing population.

The utopia around Artificial Intelligence in the times of jobless growth presents a whole new set of challenges. Is the Indian economy ready to ride the AI wave? Who will benefit from AI: investors, big tech, users, or society as a whole? What is and can be India's role in this global race for innovation? Is tech gender neutral? What about privacy and user protection? How to ensure decent work and social protection in this new age tech revolution? But mostly, how can we turn AI FOR ALL into a reality?

To foster this debate, the FES India Office has teamed up with several experts and organisations across the country to explore ground realities with the objective to understand how technology is already unfolding in selected sectors, draft scenarios of what might happen and to ensure proper safeguards are put in place at the right time.

Artificial Intelligence like any other technology is neither good nor bad. It is what we make out of it - the rules and regulations – which define the outcome of the game. Just like other countries, in India too, a mass scale application of AI is far from being established. It is still in a nascent phase and can be moulded into a success story. A success story in India AND an Indian success story for all.

Patrick Ruether and Mandvi Kulshreshtha
January 2020
Friedrich-Ebert-Stiftung, New Delhi

Note of thanks

Friedrich-Ebert-Stiftung (FES) India office is thankful to its partner IT for Change (ITfC) for preparing this research paper. IT for Change aims for a society in which digital technologies contribute to human rights, social justice and equity. ITfC is preparing a series of research papers for FES tracing AI's enigma in sectors such as agriculture, ports, education and fintech.

We are grateful to our colleagues at ITfC for preparing the research, drafting this paper and refining the manuscript to reflect our joint vision. We have to express our appreciation to the Editorial team at ITfC, for their constructive contribution and valuable time during the course of this research.

Contents

List of abbreviations

AI	Artificial Intelligence
ASER	Annual Status of Education Reporting
FOSS	Free and Open Source Software
ICT	Information Communication Technology
IDRC	International Development Research Centre
IP	Intellectual Property
GDPR	General Data Protection Regulation
NITI	National Institution for Transforming India
NROER	National Repository of Open Educational Resources
USA	United States of America

List of illustrations and tables

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This paper explores the potential impact of Artificial Intelligence (AI) on educational processes and outcomes. It examines key concerns with respect to rights-based development that AI policy and programming frameworks should address to support ethical, inclusive and universal education in India. The paper is based on interviews with educationists and organisations working in the area of AI and education, and desk research conducted by IT for Change.

1. Nature of education

Education is accepted as a public good that needs to be universally available. As Dewey discusses in 'Democracy and Education', education is essential for individuals to participate in a democratic society, enjoy their rights and fulfil their responsibilities.1 The primary purpose of education is to develop in each individual a sense of autonomy and agency, and to enable the individual to negotiate community life in fulfilling ways. The 2005 position paper by the Indian National Curriculum Framework on 'Aims of Education' views education as a socially transformative project for realising constitutional aims of building a just, free and equal society of tomorrow.[2]

If education has to be universally accessible and socially transformative, a strong public education system that can cater to the needs of all, specially the poor and marginalised sections of society, is essential. Privately funded education would not be able to meet the requirement of universal access. Martin Carnoy discusses how privatisation of school education in Chile and New Zealand increased stratification.[3]

Education as a market good tends to be inequitable. A strong public education system is essential for supporting socio-economic mobility, which is indispensable for social transformation.

In India such stratification plays out with the rich going to well-resourced private schools and the poor going to "affordable private schools" of doubtful quality.[4] Thus, education as a market good tends to be inequitable, and a strong public education system is essential for supporting socio-economic mobility, which is indispensable for social transformation.

1.1 Context of Indian education

The Indian school education system is among the largest in the world. The public education (government) system in the country, however, is weak and ill-resourced. It is battling old challenges of inadequate infrastructure, and a poorly qualified and demotivated teacher force (with teachers facing isolation and lack of trust). Teachers see their role as completing the syllabus, ensuring textbook contents are memorised by students and reproduced in written examinations, which is the primary mode of assessing learning. In this process, students often fail to develop conceptual understanding. This reliance on "rote-memorisation" of content, as opposed to "meaning-making", is a salient cause of low learning levels in schools.[5] The Annual Status of Education Reporting (ASER) reports point out that a large percentage of students in grade eight are unable to read a grade two text or solve a grade two arithmetic problem.[6]

The public education system in the country is weak and ill-resourced. It is battling old challenges of inadequate infrastructure, and a poorly qualified and demotivated teacher force.

Secondly, due to reasons such as large class size and inadequate number of teachers (corresponding to the number of sections in a school), teachers find it difficult, and in addition, may not be motivated to engage individual learners and understand their learning levels, learning needs and interests. Content, pedagogy and assessment usually follow the "one-size-fits-all" approach, leading to poor learning levels.[7]

Thirdly, Indian education is facing newer challenges of increasing privatisation and commercialisation of the sector, resulting in increasing stratification.

1.2 ICT in Indian education

To study the introduction of AI within this context of school education in India, we need to understand the status of Information Communication Technology (ICT) programs in schools. While elite private schools have adopted ICT, the ICT@School program of the Government of India has been largely ineffective in most states of India. Several studies of these programs have indicated that teachers do not integrate ICT into their teaching, and ICT infrastructure remains unused due to this and other reasons, such as poor maintenance and support.

NITI Aayog, Government of India's policy think tank, in its discussion paper titled 'National Strategy for Artificial Intelligence', declares that "adoption of new technologies is still lacking, however, (this is) often attributed to unwillingness of teachers and students to adopt technology."[8] The NITI Aayog perspective seems to cast teachers and students as passive users who should readily consume programs designed and implemented for the school system.

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ICT programs in schools have followed the BOOT (Build, Own, Operate and Transfer) model, in which the government has not just outsourced the procurement, installation and maintenance of the ICT infrastructure to private companies, but also the curriculum and teaching of ICTs. The model has largely been a failure with ICT activities remaining distinct and dis-embedded from the regular pedagogies of the school. The private vendor finds little commercial value in integrating ICT literacy aspects into pedagogical processes, as this is resource and time intensive. Contrary to NITI Aayog's view about "unwilling teachers and students", the systemic failure in technology-aided learning in reality is owing to the lack of school-centric design that can empower students and teachers alike for impact on educational outcomes. This background is relevant in unpacking AI in school education as well.

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2. AI and education

Education has been highlighted by the NITI Aayog discussion paper, referred to earlier, as one of the five sectors where AI has high potential for solving societal needs. It suggests potential use cases of AI, including "augmenting and enhancing the learning experience through personalised learning, automating and expediting administrative tasks, and predicting the need for student intervention to reduce drop out or recommend vocational training."[9]

Indian schools are usually organised into grades based on the age of the learner. However, classrooms are not homogeneous, and learning levels can vary widely across students. Teachers, usually, do not have adequate information about the differential learning levels and diverse contexts of each student in their classroom. In this context, big data can be used to develop algorithms that can address the diverse learning needs of learners by:

- Teaching through personalised education where custom content, pedagogy and assessment can be developed, based on an understanding of each student's learning level and contexts, and her/his responses to past activities and assessments.

- Providing opportunities for self-learning through adaptive practice (similar to the above, where the learner's responses to questions and activities provides the algorithms the information required to further revise/refine the content and activities that are more in line with learner needs and contexts).

- Macro diagnostics and predictive models, across groups of learners (by geography, demographic profile, grade, medium of instruction, subject and other categories) to provide inputs for policy and program.

José van Dijck elaborates how "real-time data about individual learning processes help instructors monitor students' progress and allow for corrective feedback. Personalised data allegedly provide unprecedented insights into how individual students learn and what kind of tutoring they need. And aggregated data about learning behaviour provide the input for individual 'adaptive learning' schemes".[10]

Thus, the starting point for AI in its current avatar is the availability of large volumes of data that code written by humans and generated by machines could process to derive correlations and patterns for recommending action to promote learning. In education, such big data would comprise information on learning transactions involving the iterative use of teaching-learning resources (curricular content) structured through learning activities (pedagogy), as well as student responses to these activities, which can be evaluated (assessment).

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2.1 'Datafication' in education

What organisations aiming to design and develop AI applications in education require to do is capture large volumes of resources (curricular content) with related metadata—subject area, relevant grades, language, type of resource, format of file, level of resource and role of the resource (such as introducing a topic, reinforcing learning) in teaching. They would capture actual use of these resources in different learning situations through teaching-learning activities (pedagogies) and the responses of the learners to the content through assessment processes that seek to ascertain the level of learning/understanding of the student, both before and after the transaction with a resource.

The student responses to a variety of questions/quizzes would be analysed to identify conceptual gaps, misconceptions and evaluate the extent of learning (assessment), based on which, the algorithm would suggest learning experiences that could address the gap/misconception. Students' responses to these revised experiences would again be captured in an iterative manner.

Recording millions of such responses from students to different resource units for a concept and to combinations of these resource units with different transaction methods, with feedback (on its effectiveness in ensuring learning) would help the algorithm identify the "effective" learning resources and methods given a learner context and purpose of learning. [11]

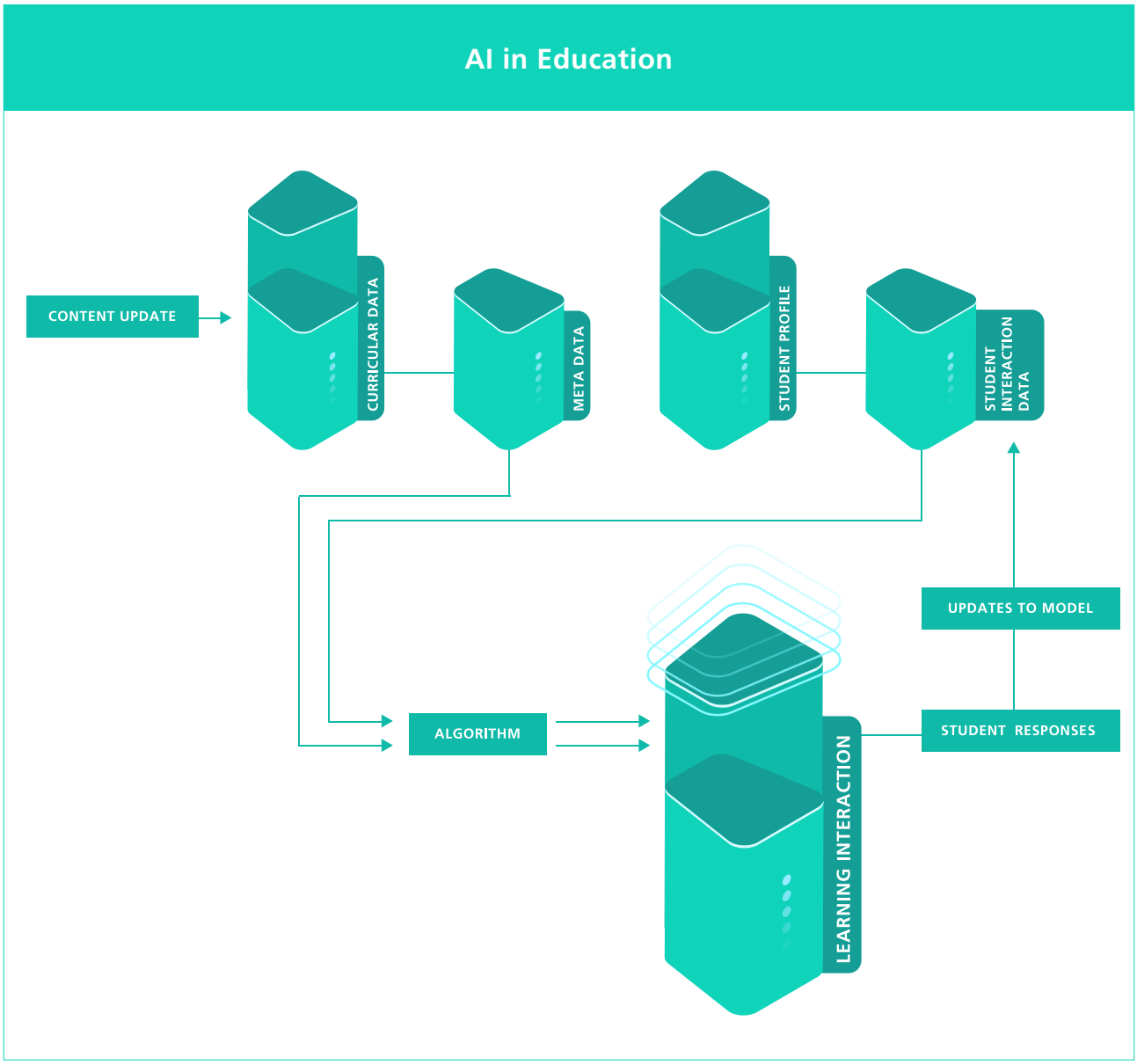

Illustration 1. Model for AI in education

While AI may not completely replace a teacher, it is seen as having the potential to assist teachers in efficiently and effectively managing multi-level/multi-grade classrooms, by judging learning levels of individual students and allowing automated development of customised educational content adapted to each student's class and learning level. Assessing work done by a student on each part/page of the learning material, for example, would allow real-time feedback on student performance to help the teacher appropriately tailor her guidance to the child.

While AI may not completely replace a teacher, it is seen as having the potential to assist teachers in efficiently and effectively managing multi-level/ multi-grade classrooms.

2.2 AI implementation in education

In India, digital education in schools is still a long way from being universalised and basic infrastructure is still not available in most schools, including electricity.[12]

The availability of digital curricular content is increasing steadily owing to Open Educational Resource (OER) initiatives of the central and state governments in India. The National Repository of Open Educational Resources (NROER) and Diksha (National Teacher Platform) are well-known OER platforms initiated by the Government of India.

In the absence of meaningful ICT integration in schools, the availability of digital data covering student interactions is negligible. However, there are private sector initiatives that seek to collect student data through their applications/platforms. For instance, an Indian company called Education Initiatives (EI) has collected data from millions of assessments through its Mindspark product, implemented in many states of India, over the last 18 years. Its Mindspark application has been used by over two million students, which has provided data that EI is analysing to provide learning paths based on learner contexts.[13] EI has developed algorithms that can analyse student responses to develop sequence of learning activities for a learner, based on their learning profile.[14] The algorithms interact with students through select sets of questions, and identifies their current learning levels and challenges and is able to provide a report on the learning level of each student in a short time. Based on the current learning level, the algorithm is able to suggest content for each student. The same approach can also be used to support self-learning.

An Indian company Education Initiatives (EI) has developed algorithms that can analyse student responses to develop sequence of learning activities for a learner, based on their learning profile.

Another Indian company, Byju's too claims to provide personalised learning paths based on analyses of learner contexts.[15] Google and Microsoft have projects in the state of Andhra Pradesh, the former with Vishakapatnam corporations schools and the latter with the state government, to analyse school drop-out data.

Many ICT programs in Indian schools use tablets that provide combinations of pre-packaged off-line content and on-line content to students. As the use of phones and tablets increases, and these gadgets play a greater role in accessing the internet, collection of student demographic and transaction data becomes easier and commonplace. In the USA, the widespread use of personal digital devices by students already allows vendors like Google to collect large volumes of data. While full-fledged personal analytics and personalised learning is perhaps still some time away, we can imagine a future where AI algorithms would predict learning paths for each learner.

As the use of phones and tablets increases, and these gadgets play a greater role in accessing the internet, collection of student demographic and transaction data becomes easier and commonplace.

3. Issues for consideration

There are several challenges to the use of AI in education. A report from International Development Research Centre (IDRC) identifies five types of short-term to medium-term risks associated with the application of AI.[16] Two of these risks—biases and lack of transparency in decision-making by AI applications—are inherent to the technology itself. The other three—increased surveillance and loss of privacy, automation leading to job loss and targeted misinformation—are the result of specific applications of AI in different domains. The first three apply to the education domain. In addition, predictive analytics pose a special threat to the primary purpose of education, which is to develop human agency.

3.1 Non availability of Big Data

Currently, schools are dispersed across the country with most of them having limited or no access to digital technologies. Hence, the collection of student transaction data on a large scale, required to build and refine algorithms, will take some time. As the NITI Aayog report emphasises, any implementation of AI must be preceded by efforts to digitise the curriculum, records of teaching and student performance. This is one reason why AI in education has not kept pace with AI in other sectors, such as transport or agriculture.

AI in education has not kept pace with AI in other sectors due to non-availability of student transaction data on a large scale required to build and refine algorithms.

Nevertheless, technology companies providing solutions to schools could be in a position to gather such data. Google, for instance, is able to collect data of the teachers and of students accessing its G Suite for Education platform. It would also be able to link this data with the data collected through the use of its other applications by the same teachers and students; Gmail, Maps, Photos, videos (Youtube) etc., some of which are a part of the Education Suite itself.

3.2 Contestation around ownership of data

There are contentious issues around ownership of data collected around teacher and student work. These include questions regarding who should be allowed to store the data collected, and who should and should not be allowed to access the data.

In an interview undertaken for this paper, a representative from Education Initiatives argued that the company owns the data collected on student assessments, as it has been captured by their Mindspark platform. This is similar to Google and Facebook asserting control (as well as ownership) of the data collected through their platforms.

The NITI Aayog report suggests that frameworks that allow for sharing of data are needed, by which monopolistic control by the data collector can be avoided. Monopolistic control over data, that too by entities primarily driven by profit motive is dangerous, as users become vulnerable to political and economic surveillance.

Zuckerberg's "privacy is dead" remark reflects a chilling reality of the surveillance state and surveillance capitalism, both of which are a threat to human security and democracy.[17] In the case of education, this risk is aggravated, as the data pertains to children/minors, who are more vulnerable to manipulation and not capable of giving informed consent. Also, collection of data from childhood increases the danger of complete loss of privacy over time.

In the case of education, the risk of monopolistic control over data is aggravated, as the data pertains to children/minors, who are more vulnerable to manipulation and not capable of giving informed consent.

Frameworks of "individual ownership" of data suggested by the NITI Aayog paper, however, can be ineffective.[18] For instance, the paper suggests that diagnostic centres (which collect data on health parameters of patients) should take the consent of individuals getting imaged, to aggregate and sell their data with compensation. In

this way, the informal market for data could be nudged towards entering the formal economy. Yet, selling individual data is complex. The terms of compensation would be impossible to decide in a fair manner. Since we have a situation of a large number of sellers and few buyers, it would mostly result in the buyer giving a 'take it or leave it' situation similar to the situation of individuals installing apps on their phones.

In addition, selling learner data in schools is fraught with ethical and pragmatic challenges. Who should sell (or license), the school or individual parents? Can they sell to multiple buyers? Should they? Do schools and school systems have the right to share, let alone sell data of their students? Should only aggregated data be made available to third parties and not individual or transaction data?

Yet, it is unclear how data ownership, sharing and control issues have been dealt with, in the few implementations that have AI ambitions in India. Handing over data of students to corporate entities without safeguards can result in public outrage, as the education department in the state of Karnataka found out when it asked a private entity to digitise student data.[19]

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Another challenge will be that AI models usually require data be collated at centralised points for big data analytics. This will tend to centralise control and ownership. However, decentralisation is an important aim of education planning, as school autonomy are essential to quality education.

3.3 Proprietary ownership of algorithms

In their AI avatar, digital technologies are not merely "tools" that teachers and learners "use", but "platforms" on which they interact. Tools can be subject to the control of the users, while platforms retain control of interactions. As Van Dijck says, "these emerging digital policy instruments transfer the assessment of didactic and pedagogical values from teachers and classrooms to (commercial) online platforms deploying real-time and predictive analytics techniques."[20] Control over the algorithms with the platform would subordinate the pedagogical aspirations of teachers and learners to the commercial ambitions of the provider.

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The NITI Aayog report, while acknowledging that algorithms and data used in an AI powered application are key elements in ensuring operational success, suggests that "it is imperative that the Intellectual Property Regime in the context of AI be robust and enforceable for innovators to have the confidence that they will be able to make profits from and take credit for their work. This is essential for the promotion of innovation, entrepreneurship and core and applied research in the field of AI."[21]

However, this "strong IP regime" contradicts the NITI Aayog's desire for a wide dissemination of AI to all countries. In case of proprietary AI regime, what will disseminate is the technology for "use", on terms given by the provider.[22]

3.4 Reinforcement of bias

AI does not provide purpose, but only an efficiency enhancing process. Algorithms constituting the AI are not "neutral" or "objective", as biases of the programmers get into the code and get amplified in Machine Learning (ML). This becomes evident in the outcomes, such as in the cases of criminal profiling in countries like the US, where algorithms have discriminated against African-Americans, or in credit scoring and insurance premia determination.[23] By building on existing understanding of the processes and role of education, AI solutions can exacerbate existing socio-economic divides.

In the Indian education scenario, the risk of bias is very high. Predominant "folk-pedagogies"[24] in India privilege education in English medium over the local/regional language, focus on "cracking the examinations" over making meaning.[25] The current syllabi overwhelmingly reflect the urban, upper caste, upper class, Hindu and male bias of the syllabi developers.[26] Derivations of such

content would also reflect these biases. The teacher profile also reflects similar biases, with teachers in government and aided schools, largely belonging to a class and caste different from their students.

Data sets embodying biases are bound to lead to predictive models that reinforce social discrimination, further impoverishing learning possibilities of students, especially those belonging to marginalised sections. This would bely the transformative potential of education in India.

India is a stratified and feudal society, with widespread marginalisation due to caste, gender, religion, class. The caste system's danger is its requirement that the son of a manual scavenger would be best placed to become a manual scavenger. Such existing biases and harmful prejudices may get amplified through AI. Rather than tackle the structural deficiencies in education that promote rote/drill learning, inappropriate curricular materials and a privileging of aptitudes over inclinations, AI may simply legitimise them. Data sets embodying biases are bound to lead to predictive models that reinforce social discrimination, further impoverishing learning possibilities of students, especially those belonging to marginalised sections. This would bely the transformative potential of education in India.

The NITI Aayog vision of using AI for identifying students for whom vocational education is appropriate, could even end up reinforcing vocational education for those sections of society that have been traditionally marginalised into traditional low paying occupations, segmenting new age service sector jobs as more appropriate for the meritocrats. AI would continue, in a more sophisticated manner, to do what the caste system did in terms of sifting people into different categories based on socio-economic backgrounds and assigning them education and vocational possibilities that further reinforce the stratification. By reproducing a future based on the past, AI discourages aspirational advancements.

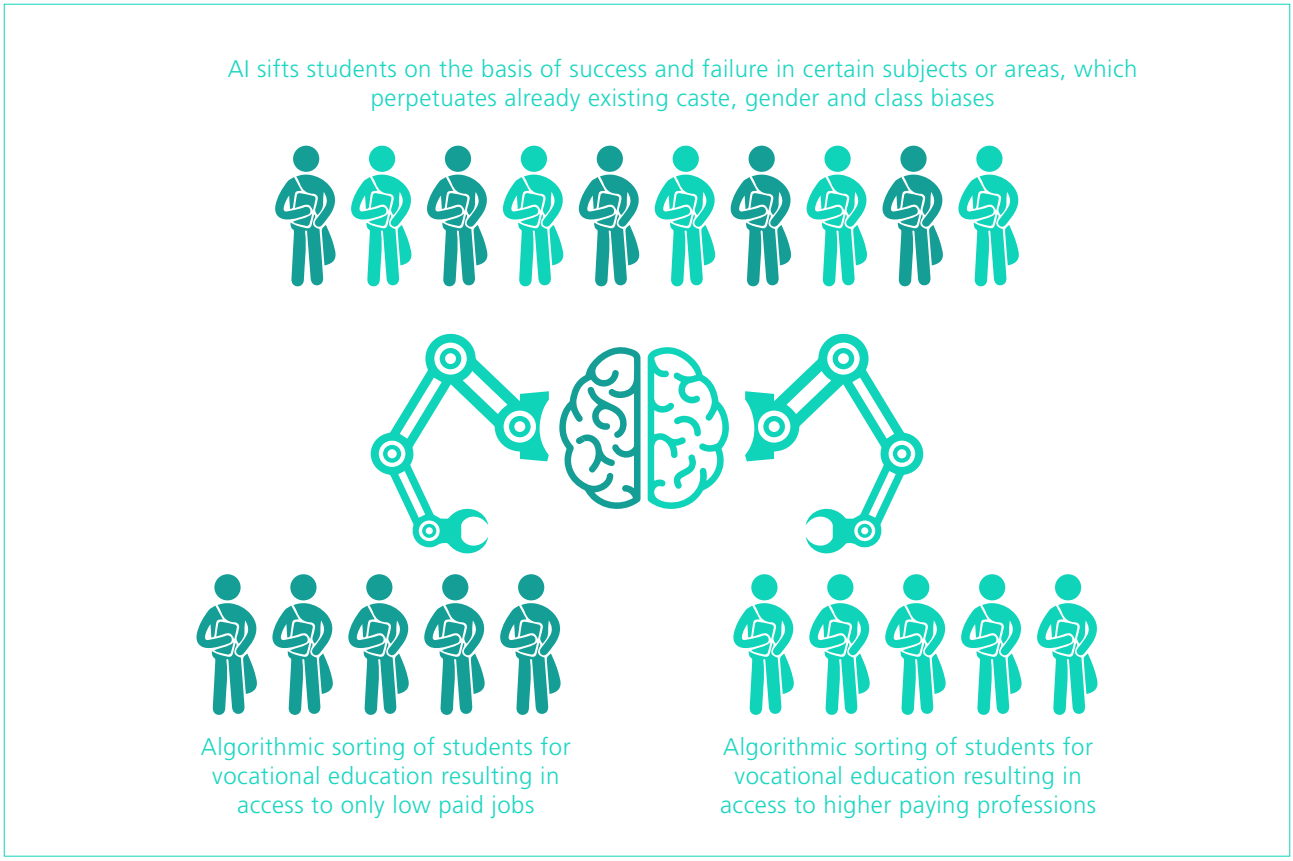

Illustration 2. AI bias

3.5 Compromising education

AI has focused on individual learning. However, education psychology, research and theory emphasises that learning is not an entirely individual phenomenon and requires the learner to interact with other learners and the teacher, who can help extend learning.[27] The reduced emphasis in AI on social aims of education (which require interactions amongst learners) would tend to diminish the social-transformation role of education by emphasising a process termed as "learnification." Van Dijck, J., & Poell, T. deplore how:

data-driven, personalized education initiatives focus on learning rather than education, and on processes rather than on teachers and students. The (social) activity of learning is broken into quantifiable cognitive and pedagogical units, such as instruction, short quizzes, assignments, deliberation with other students, and tests. The 'learnification' model is predicated on… learning rather than its long-term outcome, which is, in most schools, to provide an education.[28]

What is most needed in education is the development of a sense of discrimination, critical thinking and open-ended exploration, often touted as "21st century skills." The danger is that this is what AI-based education will weed out.

3.6 Exacerbation of larger socio-economic problems

Technology led capitalism, whose power will exponentially increase with AI, is driven by over-exploitation of natural resources. Pre–AI automation has been reducing employment opportunities, which AI will severely aggravate. Automation is already leading to an increase in income and wealth inequalities, as resources are diverted more and more to the richer classes (who benefit from automation) and away from the others (as unemployment keeps real wages suppressed).

Thus, the "efficiency" frameworks fostered by the current AI paradigm will exacerbate the larger challenges humanity faces today—environmental degradation, unemployment and inequality.

4. Recommendations

The biggest contribution that AI should make to Indian education is to promote "learner-centred" learning, where curricular content and teaching methods would be adapted by each teacher to the needs and contexts of each learner, moving from the dominant "one-size-fits-all" approach. AI could do this by suggesting diverse and contextual content and pedagogy possibilities, encouraging teachers to expand their limited content and pedagogy practices.

The biggest contribution that AI should make to Indian education is to promote "learner-centred" learning, moving from the dominant "one-size-fits-all" approach.

However, an enabling policy environment is essential so that teachers are empowered to understand the various options with respect to content and pedagogy available and decide what to use and how. Else, AI would become another force disempowering the teacher to accept AI chosen content and pedagogy choices in their practice. Given the innumerable and urgent social concerns with respect to AI in education, a comprehensive policy framework in the domain becomes imperative.

4.1 Promote teacher and student participation in AI design

AI models need to promote teacher participation in design and implementation and not treat the teacher as an uninformed consumer of AI products and services.

It would be useful here to consider the failure of the BOOT model of ICT integration, which treated the school and teachers as mere consumers of proprietary digital products. On the other hand, the participatory model of the IT@Schools program in Kerala, where teachers led the integration of ICT in schools, is a successful alternative.[29] The Kerala model of integrating ICT through teachers is now gradually being taken by up other states as well, thus avoiding the outsourcing of core curricular and pedagogical processes to external business entities.

Learning from this experience is important for designing and deploying AI programs in education. The purpose of education is to build agency and a sense of participation, a principle that AI programs would need to adhere to.

Teacher educators opening up a desktop computer, in a workshop on Digital Literacy in the District Institute of Education and Training, Dharwad, Karnataka, 2013

Photo Credit : IT for Change

Education should also support the learner to become a "responsible citizen." This means educational processes must enable the learner to question dominant perspectives and beliefs. Going against the grain may often be essential for positive progress in society. Hence, the use of AI needs to be appropriate to educational contexts and its direction designed in consultation with and participation of teachers and educators.

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Leslie Loble, Deputy Secretary in the New South Wales Department of Education, Australia, emphasises that it is crucial that educators are in the driver's seat when it comes to designing and developing AI-based systems. Teachers and school leaders must play a critical role in defining a clear purpose for AI in the classroom and be trained to understand and utilise it effectively. Leslie adds that students must also be involved in decisions about the use of these technologies and educated about the ethical frameworks that accompany their use. Their future will depend on the policies and approaches that are adopted now.[30]

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4.2 Broaden understanding of AI and technology through education

If AI has the potential to harm the processes and purpose of education, the long-term solution is education itself. There is an urgent need to introduce AI in secondary and tertiary education, to build awareness of its implications on education, as well as on society.

If schools and teachers have to be in control of AI implementation, education about AI becomes critical. Currently, AI is largely the preserve of a microscopic section of society—researchers, think tanks, few large digital corporations, first world governments. The impact of AI, however, is society-wide and its negative impact is likely to be felt more by developing countries and marginalised communities across the world.[31]

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Solutions to the problems that AI will bring have to be sought in the political realm rather than in the technological realm. Bringing about widespread awareness of AI and its potential and problems is an urgent imperative towards raising political awareness. Undergraduate courses should build critical perspectives on AI in their foundation courses in science, sociology, economics and political science, going beyond the hype that characterises popular discourse on AI. This will be necessary to design technology towards public welfare.

Secondly, appropriateness in technology adoption is an important political question that education must deliberate. This has been raised even decades ago by people like Gandhi, Schumacher and Lewis Mumsford. At this point, where the use of AI may bring about even greater power imbalances, this question becomes critical to address.

4.3 Develop frameworks for collecting, storing and sharing data in the public interest

Frameworks that ensure beneficial use of community data that is collected, without harming students and teachers, will need to be established as a pre-requisite to allowing data collection in schools. Data must be aggregated and anonymised before anyone beyond the school/teachers can access it. While data would need to be collectively owned by the school, teachers and parents (as guardians), the school would need to be its custodian.

Data must be aggregated and anonymised before anyone beyond the school/teachers can access it. While data would need to be collectively owned by the school, teachers and parents (as guardians), the school would need to be its custodian.

The danger of dilution of school autonomy and teacher/learner agency from centralisation of data collection and storage can be avoided by considering federated implementations of AI, with data and algorithms controlled

at the school level and at the district level federation of schools, rather than being entirely centralised. The notion of 'community ownership' of data referred to in the report of the Justice Srikrishna Data Protection Committee, should be further explored to support decentralised ownership, control and storage.[32] Recently, NITI Aayog has suggested that fintech data should be shared with competitors to avoid data monopolies/oligopolies.[33] Another option could be data cooperatives set up by the public education system, where public data sets are developed and data access, storage and use are based on maximising public interest rather than profit.

4.4 Establish AI in education frameworks that are free and open

Like any curriculum framework or model, algorithms must be released as open source, so that they can be subject to public review and audit. This will allow them to be scrutinised for the curricular assumptions they make, the educational aims they serve and the biases they hide.

It is also necessary that teachers should have the possibility to understand the workings of AI they use. If the AI is private/proprietary, it would not be possible for the teacher to find this out even if she wants to. Open AI can provide an opportunity for teachers (or interested others) to try to understand the working of the algorithms and provide inputs for further tweaking.

Kerala favoured FOSS and OER in its ICT programs in education, and this has allowed teachers to be co-creators and active participants. This design ensured scaling/sharing as well as avoiding rentals on software and content. Free and Open AI could be an alternative to the NITI Aayog perspective of seeing digital technology provisioning as an essentially commercial process. Also, Free and Open data sets and Free and Open source algorithms can help create a collaborative environment and inhibit data monopolies/oligopolies.

Free and Open data sets and Free and Open source algorithms can help create a collaborative environment and inhibit data monopolies/ oligopolies.

4.5 Promote research on AI and education

Any change in education has a huge impact as it affects future generations. The IDRC report warns that "if we continue blindly forward, we should expect to see increased inequality alongside economic disruption, social unrest and in some cases, political instability, with the technologically disadvantaged and under-represented faring the worst."[34] Hence, the use of AI in education should be evidenced based, through research and pilots.

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Research should go beyond first-order effects, such as increased efficiencies or accuracy of diagnosis, to include broader social effects.

Practices that support participatory design and development of inclusive AI applications need to be studied, including understanding ways by which these practices can counter bias and make AI relevant to marginalised communities.

Research on the benefits and risks and benefits of open AI (for example, sharing AI resources, datasets) is needed. Research should connect supply side questions (how best to provide open access to AI algorithms, tools and datasets) with deepening understanding of the engagement necessary to ensure that open AI resources are available for (re)use and adaptation by diverse populations (and not just by those who are already skilled and resourced).

While research would help us deepen our understanding of AI in education, an appropriate policy environment is critical to ensuring that AI can help education to deliver on its promise of being a force for social transformation, rather than of bondage.

Endnotes

[1] John Dewey, Democracy and Education, (New York: Macmillan Company, 1916), https://en.wikisource.org/wiki/Democracy_and_Education.

[2] "National Focus Group on Aims of Education" NCERT, March 2006, http://www.ncert.nic.in/new_ncert/ncert/rightside/links/pdf/focus_group/aims_of_education.pdf.

[3] Martin Carnoy, "School Choice? Or Is It Privatization?" Educational Researcher 29, no. 7 (October 2000), https://www.researchgate.net/profile/Martin_Carnoy/publication/250183359_School_Choice_Or_Is_It_Privatization/links/53d28d760cf2a7fbb2e9a6b7/School-Choice-Or-Is-It-Privatization.pdf.

[4] Geetha B. Nambissan, "Low-Cost Private Schools for the Poor in India: Some Reflections," in India Infrastructure Report 2012 (New Delhi: Routledge, 2013), http://www.idfc.com/pdf/report/2012/Chapter_8.pdf.

[5] Emphasised in policy and curricular documents, such as National Curricular Framework, 2005.

[6] Annual Status of Education Reports, can be accessed through http://www.asercentre.org/Keywords/p/346.html.

[7] Content ('what' of learning), pedagogy ('how' of learning) and assessment (did learning happen?) are the three components of the educational process.

[8] NITI Aayog, "Discussion Paper: National Strategy for Artificial Intelligence," June 2018, 35, http://www.niti.gov.in/writereaddata/files/document_publication/NationalStrategy-for-AI-Discussion-Paper.pdf.

[9] Ibid., 20.

[10] José Van Dijck and Thomas Poell, "Higher Education in a Networked World: European Responses to U.S. MOOCs," International Journal of Communication 9, no. 2015 (September 2015): https://pdfs.semanticscholar.org/c9d0/a7933dad4c445740997a232721eb34bf9633.pdf.

[11] Along with the profiles of the teachers and the learners.

[12] The Right to Education Act, 2000, prescribes minimum infrastructure that every school in India must have. It is estimated that around 10 percent of schools in the country meet these requirements.

[13] Based on interactions with Data Science team from EI.

[14] Based on interview with EI team member working in their AI program.

[15] Author could not get an interview with the Byju's team to get more information about their program

[16] Matthew Smith and Sujaya Neupane, "Artificial Intelligence and Human Development: Toward a Research Agenda," IDRC, April 2018, https://www.idrc.ca/en/stories/artificial-intelligence-and-human-development.

[17] The shipping connectivity index is based on the five components of the maritime transport sector: number of ships, their container carrying capacity, maximum vessel size, number of services and number of companies that deploy container ships in a country's ports.

[18] Barbara J. Evans, "Much Ado about Data Ownership," Harvard Journal of Law & Technology 25, no. 1 (Fall 2011): http://jolt.law.harvard.edu/articles/pdf/v25/25HarvJLTech69.pdf.

[19] See https://bangaloremirror.indiatimes.com/bangalore/others/education-dept-strikes-out-digital-deal/articlshow/63048569.cms, parents expressed apprehension about sharing of their children's data with a private entity. This agreement was subsequently rescinded, on public protest.

[20] José Van Dijck and Thomas Poell, "Social Media Platforms and Education," ed. Jean Burgess, Alice Marwick, and Thomas Poell, The SAGE Handbook of Social Media: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3091630.

[21] NITI Aayog, "Discussion Paper: National Strategy for Artificial Intelligence," June 2018, 60, http://www.niti.gov.in/writereaddata/files/document_publication/NationalStrategy-for-AI-Discussion-Paper.pdf.

[22] Ibid., Data democratisation (pg 48) v/s IP (pg 46).

[23] Kirsten Martin, "Ethical Implications and Accountability of Algorithms," Journal of Business Ethics, 2018, https://link.springer.com/article/10.1007/s10551-018-3921-3.

[24] Jerome Bruner, "The Culture of Education," (Cambridge, MA: Harvard University Press, 1996), http://www.cs.kent.ac.uk/people/staff/saf/share/great-missenden/reference-papers/brunerFolkPedagogy.pdf.

[25] An important cause for rote memorisation as the predominant mode of "learning".

[26] For instance, though agriculture is the livelihood of a majority of the population of India, agricultural practices, ideas have very little place in text books.

[27] The theory of social constructivism suggests that knowledge is constructed through interaction with others.

[28] José Van Dijck and Thomas Poell, "Social Media Platforms and Education," ed. Jean Burgess, Alice Marwick, and Thomas Poell, The SAGE Handbook of Social Media: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3091630.

[29] Gurumurthy Kasinathan. "Policy Brief - ICTs in School Education - Outsourced versus Integrated Approach," August 2009, IT for Change, https://itforchange.net/policy-brief-%E2%80%93-icts-education-outsourced-versus-integrated-approach

[30] Leslie Loble, "Learning to Live in the Time of AI," UNESCO Courier, August 17, 2018, https://en.unesco.org/courier/2018-3/learning-live-time-ai.

[31] Matthew Smith and Sujaya Neupane, "Artificial Intelligence and Human Development: Toward a Research Agenda," IDRC, April 2018, https://www.idrc.ca/en/stories/artificial-intelligence-and-human-development.

[32] B. N. Srikrishna and Data Protection Committee, "A Free and Fair Digital Economy Protecting Privacy ...," Government of India, July 27, 2018, http://meity.gov.in/writereaddata/files/Data_Protection_Committee_Report.pdf.

[33] Yogima Sharma, "Niti Aayog Bats for Ending Data Monopoly" ET Tech, May 17, 2019, https://tech.economictimes.indiatimes.com/news/technology/niti-aayog-bats-for-ending-data-monopoly/69366570.

[34] Matthew Smith and Sujaya Neupane, 20182019, https://www.cbp.gov/border-security/ports-entry/cargo-security/ctpat.

Bibliography

Burt, Andrew, and Samuel Volchenboum. "How Health Care Changes When Algorithms Start Making Diagnoses." Harvard Business Review. May 08, 2018. https://hbr.org/2018/05/how-health-care-changes-when-algorithms-start-making-diagnoses.

Bruner, Jerome. The Culture of Education. Cambridge: Harvard University Press, 1996. http://www.cs.kent.ac.uk/people/staff/saf/share/great-missenden/reference-papers/brunerFolkPedagogy.pdf.

Carnoy, Martin. "School Choice? Or Is It Privatization?" Educational Researcher 29, no. 7 (October 2000). https://www.researchgate.net/profile/Martin_Carnoy/publication/250183359_School_Choice_Or_Is_It_Privatization/links/53d28d760cf2a7fbb2e9a6b7/School-Choice-Or-Is-It-Privatization.pdf.

Cave, Stephen. "To save Us from a Kafkaesque Future, We Must Democratise AI." The Guardian. January 04, 2019. https://www.theguardian.com/commentisfree/2019/jan/04/future-democratise-ai-artificial-intelligence-power.

Chang, Lulu. "Mark Zuckerberg Wants to Share His Daughter Via VR." Digital Trends. December 11, 2015. https://www.digitaltrends.com/social-media/mark-zuckerberg-daughter-vr/.

Dewey, John. Democracy and Education. New York: Macmillan Company, 1916. https://en.wikisource.org/wiki/Democracy_and_Education.

Dijck, José Van, and Thomas Poell. "Higher Education in a Networked World: European Responses to U.S. MOOCs." International Journal of Communication9, no. 2015 (September 2015). https://pdfs.semanticscholar.org/c9d0/a7933dad4c445740997a232721eb34bf9633.pdf.

Dijck, José Van, and Thomas Poell. "Social Media Platforms and Education." Edited by Jean Burgess, Alice Marwick, and Thomas Poell. The SAGE Handbook of Social Media: 579-91. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3091630.

European Commision. "Ethics guidelines for trustworthy AI" December 2018. https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=57112.

Evans, Barbara J. "Much Ado about Data Ownership." Harvard Journal of Law & Technology 25, no. 1 (Fall 2011). http://jolt.law.harvard.edu/articles/pdf/v25/25HarvJLTech69.pdf.

Loble, Leslie. "Learning to Live in the Time of AI." UNESCO Courier. August 17, 2018. https://en.unesco.org/courier/2018-3/learning-live-time-ai.

Martin, Kirsten. "Ethical Implications and Accountability of Algorithms." Journal of Business Ethics, 2018. https://link.springer.com/article/10.1007/s10551-018-3921-3.

Muralidharan, Karthik. "Disrupting Education? Experimental Evidence on Technology ..." December 2016. https://www.nber.org/papers/w22923.

Nambissan, Geetha B. "Low-Cost Private Schools for the Poor in India: Some Reflections." In India Infrastructure Report

2012. New Delhi: Routledge, 2013. http://www.idfc.com/pdf/report/2012/Chapter_8.pdf.

"National Focus Group on Aims of Education." NCERT. March 2006. http://www.ncert.nic.in/new_ncert/ncert/rightside/links/pdf/focus_group/aims_of_education.pdf.

NITI Aayog. "Discussion Paper: National Strategy for Artificial Intelligence." June 2016. http://www.niti.gov.in/writereaddata/files/document_publication/NationalStrategy-for-AI-Discussion-Paper.pdf.

Sharma, Yogima. "Niti Aayog Bats for Ending Data Monopoly - ETtech." ET Tech. May 17, 2019. https://tech.economictimes.indiatimes.com/news/technology/niti-aayog-bats-for-ending-data-monopoly/69366570.

Smith, Matthew, and Sujaya Neupane. "Artificial Intelligence and Human Development: Toward a Research Agenda." IDRC. April 2018. https://www.idrc.ca/en/stories/artificial-intelligence-and-human-development.

Srikrishna, B. N., and Data Protection Committee. "A Free and Fair Digital Economy Protecting Privacy ..." Government of India. July 27, 2018. http://meity.gov.in/writereaddata/files/Data_Protection_Committee_Report.pdf.

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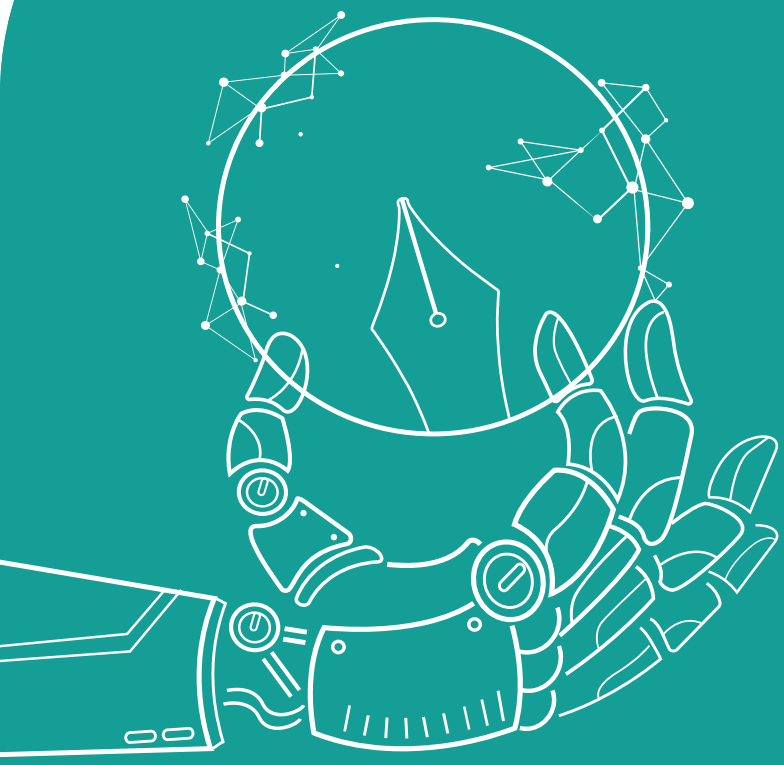

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