

# Automation of Education in the Long-Term: Flaw-Ridden Half-Solution or Epoch-Making Game Changer?

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**Abstract:** The objective of this paper is to critically examine whether automation of education, either fully or partially will be viable or feasible in the long-term. We begin this paper by defining what pedagogy is, and tracing its origin, history and development over time. We then examine language acquisition theories, both first and second, and how they have either impacted or been constrained by pedagogical theory. We then also review educational technology and computer-based education and review and trace their history. The role of artificial education in education is also examined, along with an examination of its current successes, and challenges in education. The importance of ethnography and its role in pedagogy, along with a review and examination in carrying out evidence-based, data-driven and metric-driven outcomes is also carried out. The cons of automation of education are also reviewed, and the need for a human touch, and a practical and a pragmatic approach reiterated and emphasized. The role and the importance of educational infrastructure in realizing such goals is also emphasized, and we conclude that we have a long way to go before dreaming of such goals. A meaningful and a comprehensive debate can of course, be constituted rightaway. We hope and expect that this paper will be an important cog in the wheel of our globalization of science movement, and can help is critically analyze whether, such approaches can drive education in developing countries in the long term, and optimize human capital.

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## I. INTRODUCTION

*There's a lot of automation that can happen that isn't a replacement of humans, but of mind-numbing behavior.*  
~ Stewart Butterfield

*"The first rule of any technology used in a business is that automation applied to an efficient operation will magnify the efficiency. The second is that automation applied to an inefficient operation will magnify the inefficiency."* —Bill Gates

The objective of this paper is to critically examine whether automation of education, either fully or partially will be viable or feasible in the long-term. We begin this paper by defining what pedagogy is, and tracing its origin, history and development over time. We then examine language acquisition theories, both first and second, and how they have either impacted or been constrained and limited by pedagogical concepts and pedagogical theory. We also then review much more recent concepts such as educational technology and computer-based education and review and trace their history. The role of artificial education in education which has greatly increased is also examined, along with an

examination of its current successes, limitations and challenges in the field of education. The importance of ethnography and its role in pedagogy, along with a review and examination in carrying out evidence-based, data-driven and metric-driven outcomes is also carried out. The cons of automation of education are also reviewed, and the need for a human touch, and a practical and a pragmatic approach reiterated and emphasized. The role and the importance of educational infrastructure in realizing such goals is also emphasized, and we conclude that we have a long way to go before dreaming of such goals. A meaningful and a comprehensive debate can of course, be constituted rightaway. The time is already ripe for this. We hope and expect that this paper will be an important cog in the wheel of our globalization of science movement, and can help is critically analyze whether, such approaches can drive education in developing countries in the long term, and optimize human capital. If done, it can achieve perhaps miraculous results, though only when the times comes for it. Let a million scholars bloom! Let a million intellectuals bloom! Let a million scientists bloom! Let a million though leaders bloom! If not today, at least tomorrow.

### ➤ What is Pedagogy?

The word pedagogy which refers to the art and science of teaching and learning is said to have had its origins in the ancient Greek words “paidos” (meaning child) and “agogos” (meaning leader). According to another alternative expression, the word breaks down into the two Greek words as follows: “pais” (meaning, “of a child”) and “agogos” (meaning “leader”). Thus the word “pedagogy” therefore refers to the act of leading and guiding a child. The Latin word for pedagogy is “paedagogia” which in turn is said to have been derived from the aforesaid Greek word “paidagogia”, which means “escorting or sending a child to school”. Pedagogy is therefore commonly understood the theory and practice of teaching in learning, the isolation and identification of optimal teaching and learning practices and methods, and how this process influences, and is also in turn influenced by, various social, political, and psychological preferences of learners. Some other aspects such as the interaction between students and teachers, and student and learner psychology are also researched. It has also been instituted as an academic and a scientific discipline, and is formally taught in universities and academia all over the world, particularly in the west. It is particularly for this very reason, that concepts and frameworks in pedagogy are somewhat Eurocentric in their orientation. However, many aspects of pedagogy remain poorly researched, particularly learning outcomes, and learning abilities of students in non-western contexts, by socioeconomic group, sociocultural group, learning needs and outcomes of children with special needs and different abilities, and the relationship between learning outcomes and economic outcomes. Non-formal instruction such as on and off the job skilling and vocational training are also sometimes formally adjudged and evaluated.<sup>1 2 3 4 5</sup>

### ➤ History of Pedagogy

The early history of formal and informal education remains fairly hazy and nebulous to this very day. This may be

in large part due to the fact there is a dearth and a paucity of evidence, and also because the topic remains very poorly researched to this day. Early humans, particularly in pre-literate and pre-Old World Civilizations, apparently were not imparted any form of structured education at all, apart possibly and probably basic life skills, tool making and later on in the Upper Palaeolithic age, and the Neolithic age, agriculture, some arts and crafts, and a formal structured approach to education is a relatively recent phenomenon, particularly one that is monitored and studied closely. We still have some more way to go before it can become a cogent and a coherent discipline. i.e. a data-centric and data-driven discipline. According to some researchers, the earliest formal school in any sense of the term was launched in Ancient Egypt’s middle kingdom under the supervision of Kheti, who was a treasurer to Pharaoh Mentuhotep II. Formal training may also have been imparted to a very small number of elite scribes in both Mesopotamia and Egypt who were privileged to be allowed to read, write and use early hard and difficult to master scripts such as hieroglyphs, and cuneiform. There was also probably no education for women for much longer who were typically assigned more mundane, tedious and repetitive chores, and given secondary status in society. There may have been some form of a formal or a quasi-formal training for Indus Valley administrators (by inference) but there is no way to attest to this, or reliably prove this.

In the Vedic period of Ancient India which may also be referred to as the Post-Harappan period in view of the multiplicity of cultures present in the region, Vedic knowledge along with some kind of medical knowledge was taught. The Upanishads and other literature may also have been taught along with archery and other arts, and most of the knowledge there transmitted orally, in spite of the prevalence of limited literacy in the region. A Gurukul system of education where students learnt from a preceptor in the latter’s place of residence, also existed and is attested to in some later texts, but was limited to small groups of people. During the Zhou dynasty of Ancient China which ruled from between the tenth and the third centuries before Christ, there were national schools which taught different arts, and imparted different skills such as rituals and rites, horse riding music, archery, chariot riding, drawing, painting, calligraphy and mathematics. In other early civilizations such as Greece, education was both public and private, though Greek civilization made enormous strides were made in science, arts, literature, and mathematics. The accomplishments and achievements of Greek civilization continue to be widely respected and admired to this day.

The earliest versions of modern universities were established in Western European nations such as England, Italy, and France between the eleventh and the twelfth centuries, teaching theology, science, arts, law, commerce and medicine. Some scholars consider these early universities to be midway between monastic schools or monasteries, and full-

<sup>1</sup> Curtis, Will (2011). "The Philosophy of Education". In Dufour, Barry; Will, Curtis (eds.). *Studying Education: An Introduction to the Key Disciplines in Education Studies*. Open University Press

<sup>2</sup> Curran, Marta; Rujas, Javier; Castejón, Alba (2022). "The Silent Expansion of Internationalisation: Exploring the Adoption of the International Baccalaureate in Madrid". *Compare: A Journal of Comparative and International Education*. **53** (7): 1244–1262

<sup>3</sup> Coombs, Jerrold R. (1998). "Educational Ethics: Are We on the Right Track?". *Educational Theory*. **48** (4): 555–569.

<sup>4</sup> Chazan, Barry (2022). "What is "Education"?". *Principles and Pedagogies in Jewish Education*. Springer International Publishing. pp. 13–21

<sup>5</sup> Butler, S.; Marsh, H.; Sheppard, J. (1985). "Seven Year Longitudinal Study of the Early Prediction of Reading Achievement". *Journal of Educational Psychology*. **77** (3): 349–361

fledged or comprehensive modern universities. Great Islamic centres of learning were also established after the eighth century, and Islam also had its own golden age between the Eighth and the Fourteenth Centuries. The Islamic golden age was a period of cultural, economic, and scientific renaissance with progress in science, medicine, astronomy, art, and philosophy. Modern universities are a mix of all these concepts, though many changes have indeed taken place since then. India and China also continued to prosper, thrive and flourish, though Japan and other countries were cut off from the outside world. Mass literacy levels however, were abysmally low even in the west till the 1600's, but increased gradually in the 1700's and the 1800's, as the renaissance and the enlightenment took root.

This pattern of increase in public literacy levels was not duplicated in many other parts of the world till much more recently. The Japanese education system emulated the Western Education system after the Meiji restoration of 1868 which led to the emulation of western concepts. Likewise, a Western style education was introduced in India in the 1830's based on recommendations by Lord Macaulay. While this may have benefited India greatly, some xenophobic elements want a partial reversion to the old Gurukula system of ancient yore. Education was made compulsory in most European countries only in the 1800's and the USA eventually followed suit. By the year 1900 AD, literacy levels in the west hovered at around the 90% mark, while the rest of the world lagged badly behind with low literacy rates, and non-existent intellectualism. Today, virtually all countries in the world have made education mandatory, with varying quality of education by region. Developing countries are slowly catching up with the developing world with falling illiteracy rates, though there are indeed many variations. There was a great interest in educational methods, tools, approaches and techniques in the Eighteenth and the Nineteenth centuries and several attempts were made to evaluate, compare and rank different teaching methods and create academic rationales became a true science in its own right. We need renaissances and enlightenments in the East, and that appears to be taking much longer than anticipated or expected. Pedagogy itself needs to be reinvented, and modernized though there is not much conceptual clarity yet on this vital score. Twenty first century skills also need to be taught to students such as analytic reasoning, complex problem solving, communication skills, practical learning and teamwork, interpersonal skills, as opposed to mere knowledge-based academic skills.<sup>6 7 8 9 10 11 12</sup>

<sup>6</sup>The History of Pedagogy: Gabriel Compayre D C Heath and Company 1886

<sup>7</sup> The Origins of Pedagogy: Developmental and Evolutionary Perspectives

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### ➤ Concepts in Pedagogy

Many different definitions have been proposed for the term “pedagogy”. According to a definition provided by the erudite scholar and thinker Giovanni Genovesi: “Pedagogy is an autonomous science because it has its own language and is aware of how to use it according to its own method and its own ends and, by this language, pedagogy generates a body of knowledge, a series of experiments and techniques without which any construction of education models would be impossible.” Indeed the term pedagogy is now a very wide-ranging and a very encompassing term covering a wide range and a breadth of topics such as educational content, teacher training, teacher remuneration, and motivation, learner psychology and student behaviour, and student motivation. Pedagogy may be construed as both a theoretical and an applied science, and straddles both realms in equal measure. Many different learning theories, approaches and models have been applied across the course of the history of pedagogy, and some have eclipsed others during the long course of its history. Learning theories are therefore, conceptual frameworks that attempt to understand and analyze how students acquire, absorb, retain, assimilate, digest and process knowledge during the process of formal and informal learning. According to many early and classical theorists such as Plato of Ancient Greece and later, the English philosopher and famous and eminent physician John Locke, learning was a continuous process, with knowledge built like an edifice or a house of bricks upon more basic rudimentary concepts; Therefore, foundational knowledge is very important in determining or dictating the course of affairs – John Locke also proposed the idea of tabula rasa or blank slate, where knowledge was continuously built upon an empty or a blank slate. Knowledge is acquired through a process of enculturation or acculturation, and knowledge acquired from endo, meso, and exo environments.

The first formal chair of pedagogy was established at the University of Halle in Germany in the second half of the

<sup>8</sup> Martin, Jane. "What Should We Do with a Hidden Curriculum When We Find One?" *The Hidden Curriculum and Moral Education*. Ed. Giroux, Henry and David Purpel. Berkeley, California: McCutchan Publishing Corporation, 1983. 122–139

<sup>9</sup> Giroux, Henry and Anthony Penna. "Social Education in the Classroom: The Dynamics of the Hidden Curriculum." *The Hidden Curriculum and Moral Education*. Ed. Giroux, Henry and David Purpel. Berkeley, California: McCutchan Publishing Corporation, 1983. 100–121

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<sup>11</sup> Chesters, Sarah Davey (2012). *The Socratic Classroom*. Cham, Switzerland: Springer Science & Business Media. p. 35

<sup>12</sup> Coussée, Filip; Verschelden, Griet; Williamson, Howard (2009). *The History of Youth Work in Europe: Relevance for Youth Policy Today*. Strasbourg Cedex: Council of Europe. p. 96

eighteenth century. Johann Heinrich Pestalozzi of Switzerland and Joseph Lancaster of Britain also pioneered the study of pedagogical techniques formally and scientifically. Under the supervision and guidance of Wilhelm von Humboldt, the university of Berlin was founded in 1809 which quickly and rapidly became a model for other universities in Europe to follow. Johann Friedrich Herbart played a major role in instituting Pedagogy as a separate and a distinct discipline), Immanuel Kant emphasized knowledge, human nature, learning, human values, truth, equity, transmission of values, societal norms and opportunity. Henri Bergson emphasized on perception and memory, Edwin R. Guthrie emphasized contiguous conditioning, and Stanko Gogala emphasized cultural Pedagogy. The theory of Behaviorism was proposed by eminent thinkers such as John Watson, B F Skinner (Skinner's theory was also known as "Operant Conditioning"), Edward C. Tolman ("Purposive Behaviourism" and Sign Learning), Clark L. Hull ("Systematic Behaviour Theory" or Drive Theory), and several others. According to the Social Learning theory, new behaviour is usually acquired in a social context by observing and imitating what others are doing. This concept was developed based on earlier work by Canadian American psychologist Albert Bandura and the eminent Russian psychologist Lev Vygotsky. Constructivists likewise argue that learners interpret or understand new knowledge on the basis of what they already know, and that new knowledge continuously built over existing knowledge. The Transfer of Learning Approach and Connectionism were by the American psychologist Edward Lee Thorndike and others. The Theory of Psychodynamics which is another important theory, was proposed by the Austrian neurologist Sigmund Freud who also additionally explored many other diverse topics such as psychoanalysis and hedonism. Other leading luminaries in the history of education have been the American founding father Thomas Jefferson, who, way back in the year in 1781 published his views on education in 'Notes on the state of Virginia'.

John Dewey, another highly influential educationalist, proposed the idea of functionalism, and was associated with pragmatism as well. Dewey argued that education and learning were mostly social and interactive processes, and students interacted with the curriculum, and developed their own learning processes. Margaret Haley, another educator of eminent repute, focussed on a child-centric pedagogical approach in the early part of the Twentieth century. Other influential figures in the field of education have included Daniel Payne, Paul Goodman, Edgar Z. Friedenberg, Herb Kohl, Alexander Crummell, Mary McLeod Bethune, WEB DuBois, Inez Beverley Prosser, Jonathan Kozol and Booker T Washington. Benjamin W. Arnett and Daniel Hale Williams focused on learning for blacks, and John Amos Comenius supported learning in local languages.

We also had Johann Heinrich Pestalozzi (he formulated several modern principles in education), Otto Friedrich Theodor Heinsius, Friedrich Froebel (who proposed the idea of Kindergartens), to Soren Kierkegaard, Max Stirner, and Friedrich Nietzsche, all of whom were great and eminent thinkers. These were followed by the New School or the Alternative schools movement (which included, and James Herndon), George Snyder's non-directive pedagogies (Snyders, 1974), Fernand Oury and Institutional pedagogy which focuses on the complexity of the learner and the unconscious factors which the learner brings to the classroom (Lobrot, 1967; Oury, Vasquez, 1967) and constructivism and contextual learning (This philosophy proposed by Jean Piaget, Lev Vygotsky and others, proposes an ontological perspective of how humans make an interaction in relation between their experiences and their ideas). Another important doctrine is contextual learning which places a great deal of importance of cognition and problem solving.<sup>13</sup>

There has also been a gradual shift from a teacher-centric approach with a great emphasis on rigid pedagogical content to a more learner-centric approach. Other more controversial approaches to pedagogy have been the field of "Critical Pedagogy" which is based on works by Brazilian educator and philosopher Paulo Freire. This field ties learning with oppression and social justice along with other political realities and contexts. Another new area of interest is Dialogic learning which derives its power from egalitarian dialogue where validity of arguments and not authoritarian power play the most central role. Educational Psychology is another important interface between education and psychology, and this branch of applied psychology deals with the problems, processes and products of education. It also applies the psychological principles, theories and techniques of human behaviour in educational situations.<sup>14</sup> In the 20th century, new promising trends in the field of education have included Montessori schools developed by the Italian physician and educator Maria Montessori based on a child-centric approach and development of Waldorf education first proposed by Rudolf Steiner. Language acquisition theories for both first and second language acquisition have been proposed. These include the Behaviorist theory, Cognitive theory, Nativist theory, Interactionist theory, etc. Theories must be split up into first language and second language acquisition theories, and English must be taught differently to people in developing countries or erstwhile colonized countries because it is not their first language. All these theories are driven by myopic and dyed in the wool approaches; There is no attempt to make them data-driven,

<sup>13</sup>Kennington, Richard., (1985). *The Philosophy of Immanuel Kant*. The Catholic University of America Press, Washington DC

<sup>14</sup> Freire, Paulo. *Pedagogy of the Oppressed*. New York: Continuum, 2007.



leave alone data culled from diverse cultural contexts.. At the same time, we must foster a scientific temper. Pseudo science is still rampant- people still believe in flying rishis etc- all this must change. Please refer our earlier papers on pedagogy as well, which we have published over the years. <sup>1516</sup>

#### ➤ *What is Edutech?*

Educational technology which is also known as edutech, or edtech is the use of many different technologies such as computer hardware, computer software, and concepts in and pedagogy to allow for smoother and faster learning. Therefore, educational technology combines both theoretical and practical frameworks not only from pedagogy, but also sociology, anthropology, and pedagogy, in order to arrive at a holistic, coherent, and a cogent result. Edutech comprises several domains such as computer-based training and education, online learning, mobile learning, and artificial intelligence all of which are designed to offer dynamic and pleasant learning experiences to the learner. If they are to be made into a winning proposition, they must also enhance learning outcomes qualitatively and quantitatively. According to the Association for Educational Communications and Technology educational technology is "the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources". Therefore, educational technology includes both the theory and application of the design, development, management, supervision and evaluation of technology in learning. It may also make use of equipment such as televisions, laptops, tablets, powerpoint presentations, projectors, whiteboards, mobiles, etc. Learning management systems and education management systems may also be often employed through the use of information and communication technology. Learning may be either online or offline, and face to face learning may still often be employed. Content is also digitized and highly standardized, and social media platforms may also sometimes be used.

Computer based education which was introduced in the 1970s albeit in a very small way, implies the widespread use of computers in education, often to achieve uniformity and consistency, instill and inculcate higher-order thinking and problem-solving skills. Uses of computer based learning lie in the field of teaching, mentoring, coaching, research, administration, etc. Concepts in computer based education include computer assisted Instruction for student instruction, computer based instruction, computer managed instruction, computer assisted learning, computer based training, computer managed learning, etc. Automations of lessons or tutorials, mock drills, mock exercises, training Simulations,

instructional games, etc may be used not only for problem solving, but also to boost creative thinking.

There are many advantages of computer-based learning. Computers, unlike teachers, are available all the time the learner wishes to learn. Computers are never tired and can be used to provide instruction for many hours. It allows for the learner can learn at his or her own pace. Computers do not frighten students, and most students are at ease with them. Computer learning is also increasingly less expensive than conventional institutional education. Courses can be tweaked for different types of learning, and the learning patterns or learning styles of different types and categories of students can be easily accommodated. Many foundational concepts such as the fundamentals of mathematics, physics, chemistry, botany, zoology, etc. can be taught repeatedly, and students can go through the same course again and again multiple times, without any teacher fatigue. This will also bring about a great deal of consistency, reliability, quality, and repeatability. Time will also be freed up for higher learning skills, and this will lead to improved concentration and comprehension, encourages critical thinking. It will also facilitate distance education which can particularly be promoted in higher courses – quality content will then be available online. Virtual classes can be encouraged and promoted, and brick and mortar classes kept optional. Multilingual content can also be provided, and this will help students assimilate subject matter more readily, quickly, and easily. Students can also practice at home after school hours, and the lack of parental guidance may no longer be a barrier. This will help students from the lower strata of society. Improving quality of education is also extremely important as birth rates continue to fall. We already have distance universities in India such as Indira Gandhi National Open University (IGNOU), Netaji Subhas Open University, Dr. Babasaheb Ambedkar Open University (BAOU), Tamil Nadu Open University, and Karnataka State Open University – the last one is a failed university. Even exams can be conducted online by making use of a proctor. In some cases, such universities have become successful and there has been a decline in traditional coaching centres based in Kota and other places. Gitam universities and other universities are also now developing fully digital classrooms.

Artificial intelligence is also being widely used in learning and teaching models these days, though its potential has not yet been widely tapped. AI in education allows for educators to develop useful simulations, conduct personalized tests, and adaptive exercises that are tailored for individual student's learning patterns. It will also allow for recursive learning, personalized approaches, adaptive approaches to education, better quality of education, and an overall reduction in cost. it can also be used to promote mass literacy. However, on the flip side, it may allow for the automation of bad ways of teaching, may compromise creativity, and may compromise ability to think independently. The human touch may be lost, and Human traits may not be replicable in

<sup>15</sup> Advanced Educational Psychology S K Mangal Prentice Hall India 2014

<sup>16</sup> A Textbook of Educational Psychology Hans Raj Bhatia Macmillan Publishers India Limited, 1977

teachers. Human guidance is important, and morals, ethics, values must also be imparted.

Some progress has been made in the automation of teaching. A school in Thiruvananthapuram, Kerala has launched a groundbreaking innovation in education with the introduction of India's first saree-clad artificial intelligence teacher robot named 'Iris'. This AI-generated school teacher robot, was developed by Makerlabs Edutech. This robot is powered by a cutting-edge robotics and generative AI technology, and comprises an in-built voice feature that runs on an Intel chipset. This teacher was developed under the Atal Tinkering Lab project orchestrated by the eminent India think tank NITI Aayog, and aims to revolutionize traditional teaching. This humanoid is currently proficient in three languages, though its developers plan to extend its language capabilities to cover several other languages as well. Robot Shalu is another educational humanoid robot developed by the technologist Dinesh Kunwar Patel, from Mumbai. It can speak a total of forty seven languages, Indian and foreign. Teacher robots will improve gradually as technology progresses, and this is something we can wait for.

There are many advantages of automation of education. For example, the dichotomy between global north and global south can be brought down, and the causes for differentials understood between different regions and classes of people. This will help in institute remedial measures. Customization, tweaking and modification is required to assess the needs of students belonging to different sociocultural and socioeconomic backgrounds, particularly the downtrodden and the underprivileged sections of the population. Modification and cultural adaptation are also required in many cases. Pilot studies must be carried out, and pilot studies must be carried out, capturing a wide variety of parameters. It has several other benefits too; for example, it can help overcome linguistic barriers; It can help overcome poor quality of teaching; It is a benefit for developing countries in relative terms; It can help developing countries catch up with developed ones and even leapfrog them. It can help overcome racism of many types.

However, this may only be a long term solution. There must be reliability of power, and infrastructures must be in place. The infrastructure in Indian classrooms is pathetic and most lack blackboards, reliable water and power supply and toilet facilities. Other basic amenities are lacking, and teacher absenteeism is high. Solar power, and other forms of renewable power must be used, and persovskite and cadmium telluride based options explored. The PM Surya Ghar program must be implemented; it is still in its infancy. All schools must have reliable power supply, and the current dismal scenario of unreliable power supply stopped. We are not talking about just reliable power supply here, but 24X7 power supply. In many rural regions, power outages of upto twelve hours a day are common. Indeed, we need a power revolution in India, just as we had a telecom and a highway revolution, but this is

decades away; Solar power can step in, and this is poised for a huge boom, and an exponential increase. We need to understand language dynamics, and the theory of linguistic expectation, and the theory of non-linguistic expectation. Linguistic ethnography must be used. To reiterate, ethnography is a widely qualitative research method that involves studying in order to understand their culture, social dynamics, and worldviews. It is yet to become popular in linguistics and pedagogy. In other words, more data-driven approaches are required.

There must be no technology for technology's sake, and a human touch, and a practical, pragmatic approach must be maintained. A back up mechanism will always be required, and teachers must still be qualified and trained. The quality of training must remain intact, and good teachers are still a must. This is because teachers are mentor and, guides. They provide spiritual, moral, ethical, and practical guidance to students. Output based metrics and other quantitative and qualitative metrics must be gathered at regular intervals. We must keep learning recursively from mistakes, and course corrections are always required. Theories of pedagogical content must be developed and there must be no rote learning except for the foundational elements and the basics. In short, it is a brilliant solution, but the time must come for it. Developing countries like India must use it to pull themselves up by their bootstraps and close gaps with the developed world. More debate and discussion are required, and we have time to go till technology evolves. This gives us time to debate and discuss issues deeply. We request readers to read our earlier papers and our book on pedagogy. Automation may seem like an over the top solution, but it may become mainstream eventually. This may take several decades, and we must begin with colleges and universities first. Other streams and phases of education can gradually follow suit. This approach can be used to teach in either English, or in the mother tongue. Both have their own advantages and disadvantages, and the use of automation in either stream can have their own advantages and disadvantages. More and more research papers are required, and we can understand that education makes or breaks nations.

Automation can also solve many problems in this day and age of obsession with English education which has its own benefits and drawbacks. Many teachers cannot speak English properly – this is the biggest obstacle to English medium education. High quality teacher training is also required. However, bottlenecks will remain. Automated education cannot be a substitute for good quality teachers, particularly at lower levels of education. We must remember that teachers provide students succour; teachers provide students empathy; teachers shape moral values; teachers shape cultural values; teachers provide a human touch; teachers shape students' personalities; teachers are specially important in lower grades. However, education can be gradually automated as students become more emotionally mature. Composite approaches can also be adopted. Government can also initiate pilot studies on the automation of education, and

educationalists, sociologists, and anthropologists roped in as required. In short, it is a brilliant solution, but the time must come for it.<sup>17</sup>

## II. CONCLUSION

The objective of this paper has been to critically examine whether automation of education, either fully or partially could be viable or feasible in the long-term. We therefore began this paper by defining what pedagogy was, and tracing its origin, history and development over time. We then examined language acquisition theories, both first and second, and how they had either impacted or been constrained by pedagogical theory. We then reviewed educational technology and computer-based education and also reviewed and traced their history. The role of artificial education in education was also examined, along with an examination of its current successes, and challenges in education. The importance of ethnography and its role in pedagogy, along with a review and examination in carrying out evidence-based, data-driven and metric-driven outcomes was also carried out. The cons of automation of education were also reviewed, and the need for a human touch, and a practical and a pragmatic approach reiterated and emphasized. The role and the importance of educational infrastructure in realizing such goals was also emphasized, and we concluded that we have a long way to go before dreaming of such goals. A meaningful and a comprehensive debate can of course, be constituted rightaway. The time is already ripe for this. We hope and expect that this paper will be an important cog in the wheel of our globalization of science movement, and can help is critically analyze whether, such approaches can drive education in developing countries in the long term, and optimize human capital. If done, it can achieve perhaps miraculous results, though only when the times comes for it. Let a million scholars bloom! Let a million intellectuals bloom! Let a million scientists bloom! Let a million though leaders bloom! If not today, at least tomorrow.

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<sup>17</sup> Introducing Anthropological Pedagogy as a Core Component of Twenty-first Century Anthropology: The Role of Anthropological Pedagogy in the fulfilment of Anthropological and Sociological objectives, Sujay Rao Mandavilli, *International Journal of Innovative Science and Research Technology(IJISRT)* Volume 3, Issue 7, 2018 (Summary published in *Indian Education and Research Journal* Volume 4 No 7, 2018)