Sociology of Science

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Lecture - 19
Science, Technology and Colonial Power in India-Part II

Dear, students in the previous lecture we discuss the reasons for decline of indigenous education system of India. We also discussed how the Macaulay minutes of 1835, introduced English as a medium of instruction in Indian education system. We also discussed how the decision of the East India company to resume collecting revenue from the rent free lands that were given to the Indian educational institutions, led to further decline of Indian education system; the indigenous system for education.

We also discussed how James Mill and his utilitarian philosophy was practiced in India through his supporters, who came to India as administrators; colonial administrators. We also talked about the fact that there was a debate and conflict between the Anglo cyst and orientalists regarding the faith of indigenous languages. While the orientalist, we are talking about continuing and preserving the indigenous languages the orientalists were in favor of introduction of western model of science, European model of science which they felt is more accurate more precise.

And Indian education system the felt is not up to the mark is devoid of reason logic which supported religious bigotry and orthodoxy. Now, we also talked about the fact that 1850s before the Sepoy Mutiny or the first war of independence Marquess Dalhousie introduced railways, telegraph system and postal system.

Reorganized, reformed postal system with the which he felt is going to lead to social and economic transformation of India and would also help increase the revenue from Indian colony, the reason why railways was introduced we know it just. So, that the cotton which was being produced and cultivated in Deccan that could be transported to madras port or to Bombay port in quick time so, that it can go to Britain where the industrialists manufacturers in sitting in Lankasri, Manchester or Liverpool. They could process it fabricate it and send back the finished product to India for sale, also they felt by introducing railways and telegraph system they will have better communication and they will have better law and order control over the country.

The missionaries felt that the in trend by making people from different caste sitting together they would be able to dispel the traditional religious thoughts from the minds of the Hindus, traveling in train would trigger different thought process in their mind. They would be able to appreciate that there is a life beyond the Hindu religious system. So, that was their interpretation that was their perspective hence they felt that railways would be introduced, but on the contrary, but it actually led to is that it led to a new kind of class system with a new kind of caste system.

The railways led to a new kind of caste system where the British would occupy the first class, the Anglo Indians the second class and the Indians the third class compartments. Also trains had to be any in the initial days of introduction of railways trains had to be stopped for half an hour, 1 hour, 2 hours. So, that the natives could prepare food by the side of the train have their food and again resume their journey it was due to the dietary restrictions and restrictions of social distance between different castes. So, caste system did not go away economic transformation that they visualized also did not take place.

It actually led to further decline all this it is the colonial policies there were a lot of fault in the colonial policy .They were not targeting the structure they are not looking for structural changes in the system. They were not trying to industrialize Indian economy, rather they were trying to depend upon agriculture and agriculture was in the decline because of famines and series of droughts which led to the kind of famine.

In fact, in order to solve this problem this started canal irrigation projects one outcome of that canal irrigation project is the Ganga canal project, which was introduced in 1845 and because of this project they built the first civil engineering college in the entire Asia at Roorkee; where the natives could be trained in civil engineering. So, that that saves late more money for the east India company of importing the military engineers from Britain and also the natives could communicate in local languages to the laborers.

Now, these are the state of affairs till 1857, with Sepoy Mutiny or the first war of India independence. The after the separation of Sepoy Mutiny in 1857, the crown rule was introduced in India. India came under direct rule of crown the queen, with that there was a change in the approach of the colonial administrators regarding the science and technology policy. From there on they decided to rule the country partly by concession in part by force and in part by constant intervention of new scientific forces.

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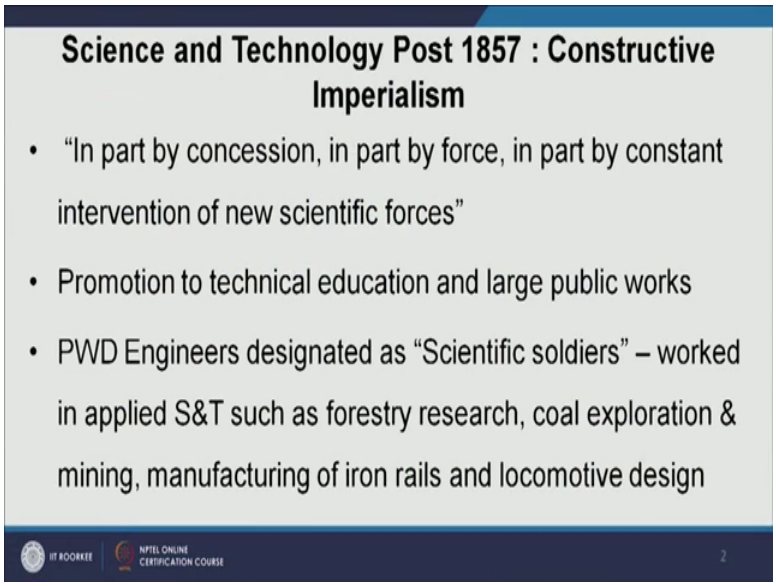

So, there was an impetus given to technical education and large public works now this is a period of constructive imperialism because they wanted to introduce scientific forces. Through technical education, through research and agriculture research and forestry research in solar physics and that would lead to for the development of Indian technology, Indian science and technology. Now, the PWD that is public work departments were set up all over the country.

Those who were working for public works department, they were designated as scientific soldiers and they worked in such applied fields such as forestry research, coal exploration, mining manufacturing of iron rails and locomotive design. The idea was to apply practical knowledge of science into solving the problems of the country in terms of and that could be done by introducing research in the field of forestry, in the field of coal exploration and mining by manufacturing of research into the field of manufacturing of iron rails and locomotive design.

But the focus was on application of scientific knowledge, on technology; not on science, not on theoretical science, not on basic science because they felt that the funds are limited and this limited funds should be used for improvement in the agriculture system. If agriculture system could improve that would lead to more revenues, they were not actually targeting or addressing the structural problem. They are not looking at the land

settlement system, they are not looking at the irrigation charges, they are not looking at the permanent settlement that was introduced by the British this.

They are not looking at industrializing the Indian economy because Indian economy was completely dependent on agriculture. If there is shortage of if there is a low rainfall, if there is a drought it would lead to scarcity of food; it would lead to famine. Now, the Indians because of their over dependence on agriculture they were not able to make sufficient money because everything was dependent on the rainfall, amount of rainfall. The in each year they were not looking at industrializing the country, they are not introducing industries manufacturing units on the lines of Manchester or Liverpool.

They were looking for more revenue from the agriculture sector; hence any science and technology intervention by the British in the post 1857, was in the field of agriculture and the fields related to that, but that was not solving this irrigation project that would did not solve the problem.

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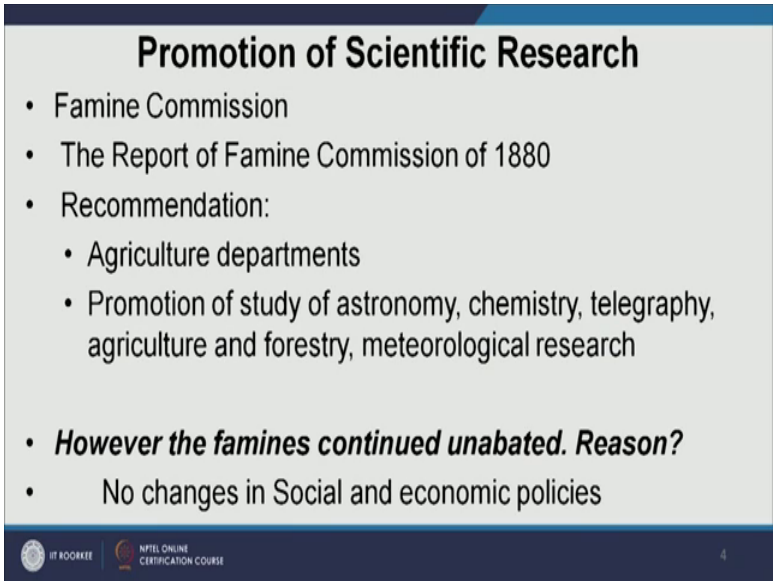

They started constituting Famine Commissions, the famine commission came gave its report in 1880 a 1880 that report recommended agriculture departments, promotion of study of astronomy, chemistry, telegraphy agriculture and forestry meteorological research. In order to address the problem of famine, in order to improve the agriculture system, in order to provide a solution to low rainfall.

In fact, there was also focus on solar physics because this some studies which came up in 1870s and 1880s which linked low rainfall to sunspot activity. Hence, there was focus on solar physics, there was focus on and the as the as per the report as per the recommendation there was focus on study of astronomy, chemistry, telegraphy, agriculture and forestry, meteorological research.

Based on these recommendations agriculture departments were set up and all the provinces and also at the center, but the irrigation projects also started. However, famine continued unabated, what is the reason? There was no change in the social and economic policies, there were no structural changes, there was no effort to industrialize the country.

On the lines of Manchester or Liverpool, there was no focus on reorganizing the land settlement system. The irrigation charges, they were not looking at any structural changes they just trying to improve the agriculture system so, that the famines could be stopped.

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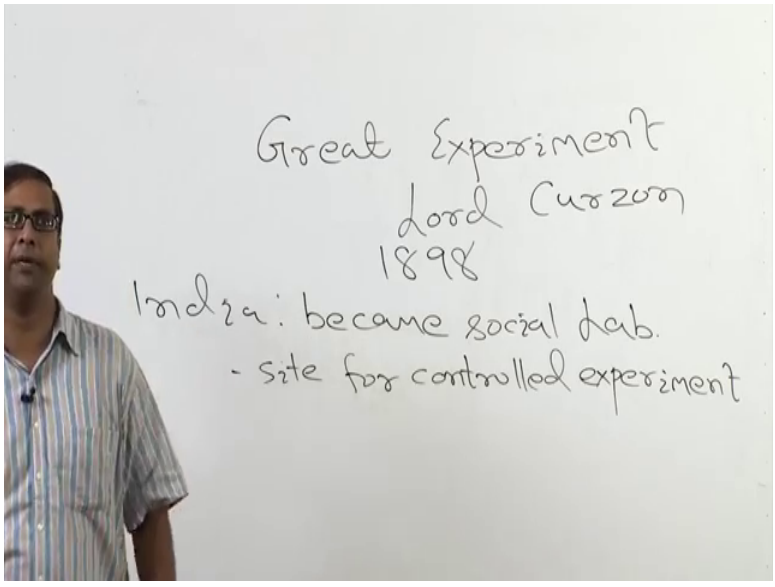

Now, next phase comes that is a period of great experiment, Lord Curzon. He became the viceroy of India from 1898; he introduced a lot of scientific programs to improve the science and technology in India. Idea continued to be the same that is more revenue generation directly or intraday indirectly, through this intervention of science and technology. Idea was to stop famine so, that the life stocks could be saved human lives could be saved and agricultural productivity could be increased.

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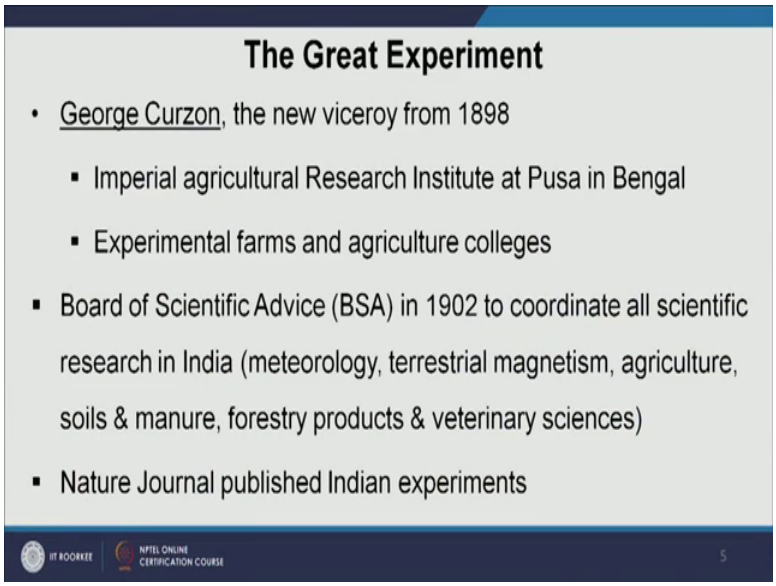

To address this issue he established the imperial agriculture research institute at Pusa in Bengal. There were experimental forms and agricultural colleges that were established in different parts of the country. Board of Scientific Advice BSA, was established in 1902 to coordinate all scientific research in India. Mostly the scientific research pertained to meteorology, terrestrial, magnetism, agriculture, soils and man manure, forestry products and veterinary sciences.

He wanted to make India the social laboratory, new experiments were introduced, new experiments were conducted and the results from these reports were reported in the journal nature. So, nature published this Indian experiments whatever that was done in India and in which made with success regarding agricultural productivity or regarding, any other research regarding, mining regarding veterinary sciences or forestry products. All these things were replicated in Britain the I have already told you that the Britain did not have canal irrigation system.

Hence, the Ganga canal project one of the purpose of that is to replicate the success of canal projects in India, in Britain. They also did not have any technical institutes per say. So, first technical institute was established in Asia at Roorkee which also led to replication of such model in Britain. So, the experiments that were taking place under George Curzon, the viceroy of India in 1898 onwards. All these experiments were being reported in nature and there also the success models were replicated in Britain. Board of

scientific advice was first of his kind where o which became the nodal agency of all the research that was taking place in India.

It was the centralized institute; a similar kind of scientific organization was established in Britain.

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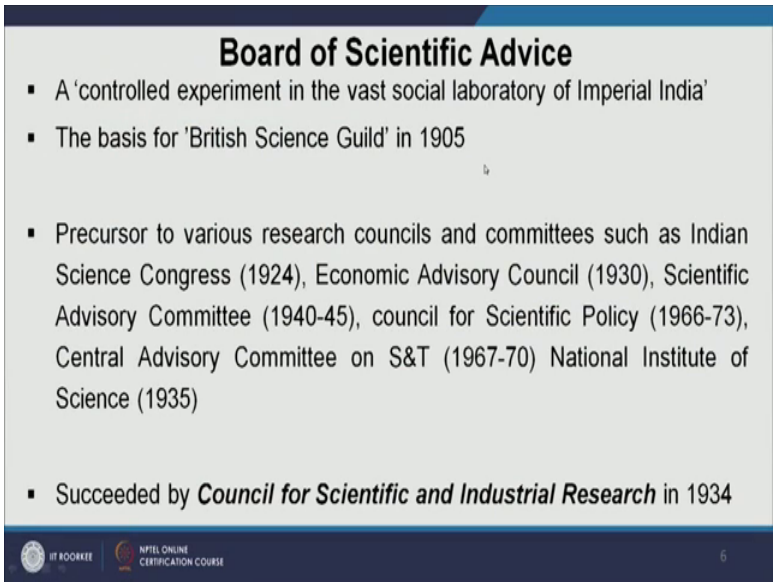

And that was called the 'British Science Guild' in 1905 which was similar to board of scientific advice of 1900 of 1902. Now, India as I told you became a controlled experiment in the worst social laboratory of imperial India. So, India became a site for controlled experiments became a social laboratory, vast social laboratory for any experiments which could be the successes could be replicated in Britain.

Now, as I told you board of scientific advice BSA was established, which coordinated all scientific research in India. In the field of metrology or terrestrial magnetism or agriculture or forestry products of veterinary sciences, it became the nodal agency. And similar kind of institute was also established in Britain, in the form of British science guild in 1905. Now, this BSA became precursor to various research councils and committees which were established in different point of time in the first half of 20th century in British India.

Like for instance Indian Science Congress was established in 1924, Economic Advisory Council came up in 1930, Scientific Advisory Committee came up in 1940- 45 period,

the council for Scientific Policy which came up in the post independent in India in 1966 to 73, Central Advisory Committee on scheduled tribes, on science and technology in 67 to 70 period and National Institute of Science in 1935.

Now, all these institutes which came up during the British India which were the offshoot of BSA board of scientific advice. All this led to formation and establishment of council for scientific and industrial research which we otherwise known as CSIR, it came up in 1934. Now, this is as far as the research in the field of science and technology is concerned; till independence we have the phase of great experiment under the leadership of Viceroy George Curzon. Where India became a experimental site agricultural institutes, where established agricultural colleges, where established in Bombay, in Pune, in Madras.

There were research which were focused on veterinary science, soil research, agricultural research, forestry products, metrology. The now before that Marquess Dalhousie introduced railways, telegraphs as communication and transport for better transportation and communication and reorganize the postal system. Ganga canal project for similar kind of canal irrigation projects were introduced all over the country to improve agricultural productivity.

But throughout this effort there was a clear cut science and technology policy by the British and that is to encourage applied science, practical science, application of theoretical science for practical purposes. The theoretical science, basic science, fundamental science was decidedly discouraged. The reason they said is that first there is limited funding available.

So, let us use that funding for applied solutions that will solve the problem of agriculture and that will lead to more revenue generation. So, the how did the Indian scientists; how did the Indian Intelligencia responded to such British policy of science and technology.

First we take the case of Indian Intelligentsia, the Indian Intelligentsia they quickly realized that British education system, western model of science is directly linked to their social mobility and economic gains. So, they could rise in the social hierarchy quickly if they embrace the western model of education. It will be easier for them to get into the colonial administration and that is the route to status enhancement. They could get more

social status; they would be economical in a better position. If they adopt, embrace the western model of education.

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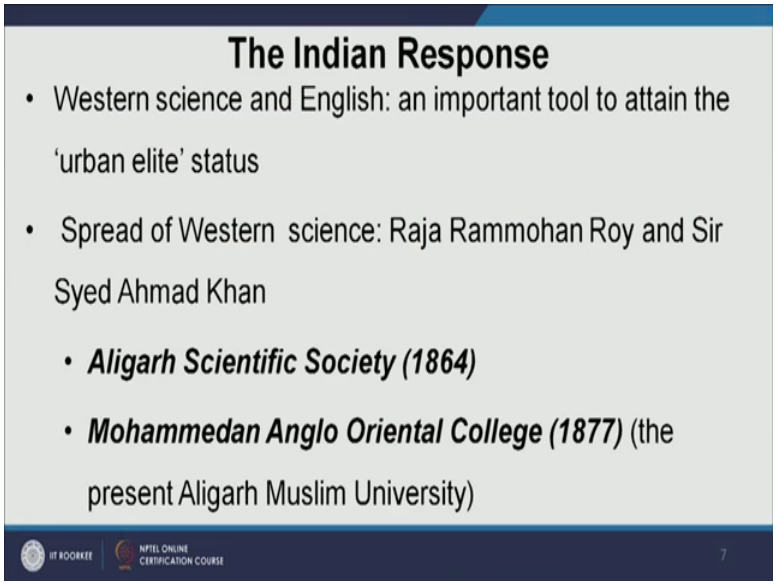

Raja Ram Mohan Roy was a reformist of that period, he felt spread of westerns science is going to help the Indians and is the only way forward. He for instance said that ah, in fact, he made a request to Lord Amherst to discontinue Sanskrit education. He felt that Sanskrit with his grammatical niceties and metaphysical thought is not going to help India on the path of science and technology development. Hence, there is a need to adopt western model of science in India.

So, he fought for a western model of education, he stood for those Indian Intelligentsia who felt that western system of education, western model of science English as a medium of instruction is going to help the Indians further in the social mobility and the economic success and it is going to lead India into the path of science and technology development. Similarly, Sir Ahmad Syed Ahmad khan who is whom we associate with Aligarh Muslim University.

He established the Aligarh scientific society in 1864 and he felt that introduction of western model of science is going to help Islam, in getting rid of its orthodoxy and introducing reason into a religion. He felt by western a by exposure to western education Islam or the [FL] in India would be able to imbibe, incorporate reasoning in the thought process. He also was a strong advocate for western model of education.

In fact, he made an effort to translate the western literature western scientific treatises in indigenous languages in Persian or Arabic languages. So, that there is more diffusion and spread of western science and western model of education in India. He also went on to establish the Mohammedan Anglo Oriental College in 1877, which now has become a Aligarh Muslim university.

So, these are the examples one from a Hindu reformer another from a Muslim reformer who stood advocated for western model of education, development of western science in India. Now, how did the Indian scientists respond and how are the Indian scientists treated during that time. Let us take the example of two great Indian scientists the tremendously talented Jagdish Chandra Bose, was a physicist who took his degree from Cambridge and P.C. Ray who took his DPhil in chemistry from Edinburgh University.

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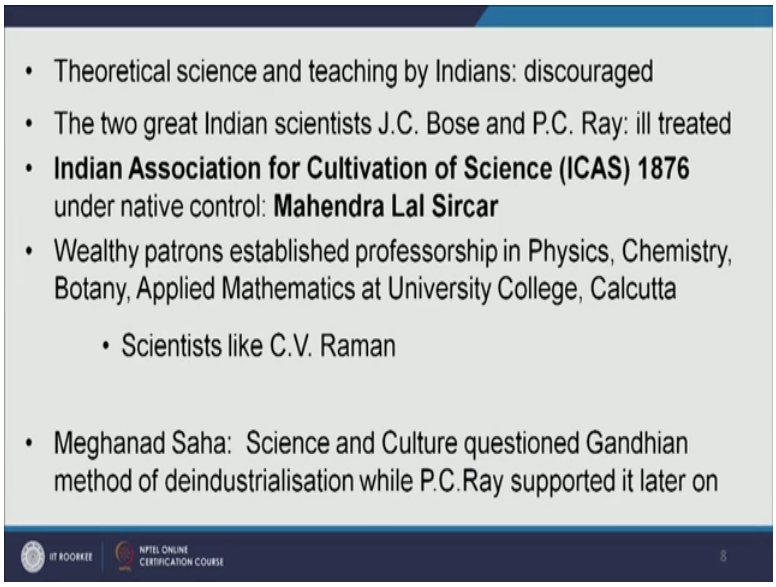

Now, when this both these people came back to India after obtaining their degree in physics and chemistry respectively when they came back to India to Calcutta. They were finding it difficult to get a suitable job because of that racism because of discrimination against. The Indian scientists the Indian scientist were incapable or considered incapable of fundamental research. They were considered to have no aptitude for teaching theoretical sciences.

And in fact, this highly qualified educated Indians when they came back to India many of the universities which were run by the British or professors they did not want them to

teach altogether. Not only it was considered that this Indians lack aptitude in theoretical science, in fundamental science. Also they it was perceived that this Indians are incapable of teaching scientific subjects. Hence this foreign professors English professors, who are teaching in Indian universities they were not in favor of appointment of Indian scientist, Indian professors.

As I told you Jagdish Chandra Bose when he came back to India, he was told to join as a junior professor in presidency college Calcutta in 1885, but the condition he would have to accept two third of the salary of a British professor. Jagdish Chandra Bose protested silently by not checking, not touching his paycheck, but he continued to teach, but he did not take any salary. P.C. Ray was not appointed an assistant professor initially in Presidency College. Now all these things led to lot of dissatisfaction amongst the qualified Indian scientists, one of those education is Mahendra Lal Sarkar, he could understand such British discrimination and racism.

So, he wanted to change all that so, he established the Indian association for cultivation of science in 1876 which was under native control and management. As there was no issue of any interference from the government or the state or from the British professors or a British scientists. Wealthy patrons established professorship in physics, in chemistry, in botany, in applied mathematics at university college Calcutta.

Wealthy patrons also provided funding for instance maharaja of Asianagaram provided support financial support to Indian association for cultivation of science. So, all these efforts led to further development of science and technology in India. Now, in fact, one of the products of Indian association for cultivation of science is C V Raman, who went on to get a noble prize in physics in 1930. Then comes scientists of India who responded to the British policy as well as to Indian policy after independence, that is one of them is astrophysicist Meganad Saha. He was not only a scientist, he was also a politician who stood for election. Since he opposed Gandhian philosophy of cottage industry village industry and he was a strong advocate of industrialization.

Initially, he was not accepted by the congress because congress under the leadership of Gandhi, was arguing for going back to agriculture going back to village industry ,cottage industry. Meganad Saha said that industrialization is the only way forward, he in fact, wrote he and his a group of scientists who were with him they wrote around 20, 100

articles in a popular journal called science and culture where they talked about the advantages of industrialization in India and also criticized the Gandhian philosophy.

Now, his policies because he stood for election as an independent candidate and won the election in 1951, parliamentary elections and became incorporated into a different committee scientific committee; which would decide policy matters regarding science and technology development in India. He could have a great effect great impact on the development of science and technology in post independent India, but his carrier started much prior to that during the British era; where he was a vociferous critic of Gandhi and as a strong supporter of industrialization.

P.C. Ray initially supported industrialization, but later on he felt that probably Gandhi was right. Now, we come to the third significant scientist of that era from India that is Srinivas Ramanujan who felt that mathematical equations express the thought of God.

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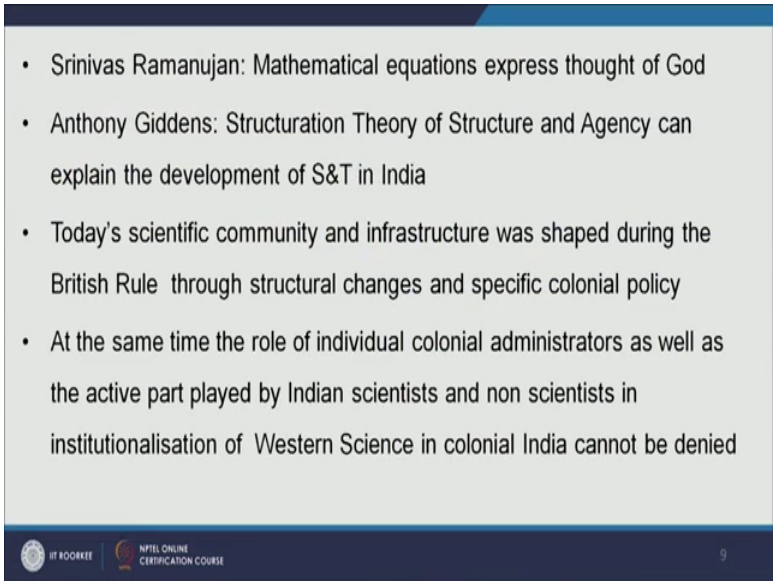

And mostly when he was solving mathematical problems, he was invoking the god goddess Namgiri. For him everything that he was doing in mathematics is a expression of god or expression of Hindu gods and goddesses. He was a genius, but he was not able to provide any logical reasoning for his mathematical solutions. All that he was relying upon was his power of calculation, was power of intuition and patience. Now, having discussed the Indian response to science and technology.

Now, we come to the conclusion that British policy varied from complete disinterest in the early phase of colonialism to constructive imperialism and the post 1857, to the phase of great experiment under George Curzon and throughout the idea was to generate revenues. And by that through and trying to do that by improving the agriculture system and hence many researchers, many carrier research institutes in agriculture establish, many canals were established and it also led to some development of allied subjects.

Indian Intelligentsia whether it is Hindus or the Muslims, they embraced the western science because they felt that is a route for social and economic mobility. The Indian scientists were initially were not given importance by the British educators because they felt that Indian scientists are incapable of theoretical science, are incapable of they lack the aptitude to teach. They got support from Indian association for cultivation of science under Mahendra Lal Sircar.

So, all these things finally, leads us to conclusion that within the framework of Anthony Giddens; his theory of structuration. All these things can be explained within the theoretical structure of Anthony Giddens, his idea of structure and agency. The structure, the colonial policy, structure the administrative initiatives and agency.

The certain colonial administrators like James Mill or Marquess Dalhousie or Lord Curzon or Indian Intelligentsia like Ram Mohan Roy or Syed Ahmed khan or Mahendra Lal Sircar. How they responded to, reacted to the British policy? So, this is a combination of structure and agency which formulated and laid the foundation of science and technology development in colonial India. So, here we have come to the end of this discussion on the development or lack of development of science and technology in the colonial India.

Thank you.