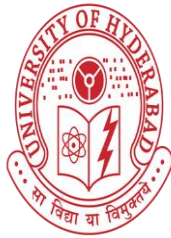


“Education in Ancient India with special reference to Taxila University”.

***A Dissertation presented for the award of the degree of
Master of Philosophy***



SUPERVISOR: Prof. K.P.Rao, Department of History, School of Social Sciences

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CERTIFICATE

(for M.Phil and M.Tech. Dissertation)

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requirements for the
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diploma.

Supervisor/s Head of the Department/Centre Schools' Dean

(i)

Acknowledgement

In the name of God He who has created man, and taught him speech. He who taught (the use of) the pen, taught man that which he knew not. It is His benevolence which made me able to complete this M.phil programme.

At the outset I owe sense of gratitude to the person who has infused in me the spirit of devotion and dedication for this work. So I am profoundly indebted to my esteemed supervisor Prof. KP Rao, Department. Of History, University of Hyderabad, he always and continuously bolstered my morale by his creative guidance and reflective thinking. His sensible supervision and inspiring opinions helped me to complete this dissertation well in time.

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SAURABH SHUBHAM

(iii)

Preface

Takshasila University was one of the oldest universities of the world . It has several hidden aspects , which need to be rediscovered . In this small effort, I have made each and every attempt to uncover the glorious history of the first university of Ancient India . The word ‘Taxila’ has been used almost everywhere , in similar meaning with Takshasila University , in British and Greek styles .

Every attempt has been made to avoid any error.

Any suggestion for improvement ,from my respected teachers and other readers are most welcome.

Responsibility for any types of errors are mine.

SAURABH SHUBHAM

Research Scholar

Chapter I**EDUCATION IN ANCIENT INDIA: A GENERAL OVERVIEW**

The aim of this dissertation is to trace the various aspects of education at the ancient Taxila University. We aim to trace the faint beginnings of Taxila as a learning centre, its geographical, economic and cultural peculiarities, including the accounts by foreign travelers. We will look into the achievements by the notable alumni and also the archaeological details in a brief manner. It is claimed by nationalist Indologists that this was the first University of the world, but we need to analyze any historical claim critically and before we go deep into its various aspects and approach it scientifically, we need some preliminary information which is explained below.

Hypothesis

The term ‘University’ in Ancient India did not mean or represent the present day ‘university,’ rather a particular area was known for its scholarly teachers, who personally supervised the learning of a group of students, which was called the Gurukul system.

Moreover, we need to keep in mind the chronological and geographical factors. Since Taxila was claimed to have the beginnings right from the Pre-Christian era, in the ‘Sapt-Sindu’ area Aryans were in a settled stage and needed various professionals like priests, soldiers, archers, administrators etc. This was the ‘Homeric Age’ in Ancient Greece and in China and other Asian countries, only educational (specialised) institutions had been established, for the elite or military purpose.

Review of the Sources

The main secondary sources like ‘The Historic City of Taxila’ by A.H. Dani (UNESCO), ‘Education in Ancient India by A.S. Altekar and ‘Universities in Ancient India’ by Apte have mentioned, at the most only positive aspects. But we also need to have an eye upon the limitations of the Taxila school, which may be enumerated below.

- a. Dominance of the oral tradition and lack of proper written work.
- b. No examination system was present.
- c. Since the discipline was high and involved high ethics and moral order, many students couldn’t complete their studies.
- d. Alexander the great took away several philosophers and scholars who never returned back.
- e. Political instability constantly hampered the continuous growth of Taxila.

Presently, two Pakistani scholars- Salman Rashid and Ihsan H. Nadiem are trying to uncover various aspects of Taxila and its evolution, progress and decline. Though several Indologists argue that Taxila was established at a very early Period, still we need to reach a consensus on its beginnings. Some scholars like Needham Joseph have worked on China and Mesopotamia in the Ancient Period, but Indologists argue that Taxila was a globally reputed institution. So, we may compare the theological aspect of Ancient Egyptians, Chinese and Mesopotamians with the Taxila theology (which was multicultural- having Brahmanic, Buddhist, Greek influences too).

For deep study, we must focus on the several sites like – Bhirmound, Sarisukh and Sirkap and its surrounding areas and the recent researches like Bakhshali manuscript etc.

Recent steps like digitization and conservation from UNESCO have helped to preserve the permanently damaged world heritage site to a large extent.

Education In Ancient India - A General Overview

Education system in Ancient India may be divided into Brahmanical, Buddhist and the Vedic for the sake of convenience. Taxila had undergone all the three phases being the oldest centre of learning university is not accepted by some scholars¹ in the Indian sub continent. In this chapter, we will discuss the chief characteristics, which defined the above three types of systems.

In recent times, many new researches and claims have been made and efforts made to include them and review them critically. Since we have no idea about the education system of Indus valley civilization, we can only make vague possibilities about the influence of Indus valley culture on Vedic culture,. But we may see several aspects of Indus Valley religions like the worship of Pipal tree, the worship of Shiva-linga² and several other practices. But first of all let us make some research about the Ancient Indian Education System and then subsequently become specific about Taxila/Takshasila, which is called the world's first university by many hard core Indologists.³

General Characteristics of Ancient Indian Education

Several scholars like A.S. Altekar (Education in Ancient India) and others have concluded the following characteristics about Ancient Indian Education.

¹ Scharfe, Hartmut, *Education in Ancient India*, Brill Academic Publishers, 2002, p.145.

² Basham, A.L., *The Wonder that was India*, Rupa and Co., 1954, p.23.

³ Apte, D.G., in his *Universities in Ancient India*, MS University Baroda, (Publication Year Unknown but preserved in Cornell University e Library),p.4.

1) **Physical Development:-** It was said that the medium for doing our worldly duties is our human body. It stressed upon keeping oneself fit and healthy.

2) **Mental and Spiritual Development:-** The basis of ideology of the Rigveda and other texts was to let noble thoughts come to us for each and every corner of the world. They were of the opinion that a God Varun guided the cosmic order and was aware of each and everything happening in the world.⁴

Many exercises of mind and body were carried out (as mentioned in the YOGA SUTRA of Patanjali. There are also examples from Hathyoga.⁵

But environment and environmental conservation were central themes in the daily life of the people governing their each and every aspect of every activity.

3) **The subjects taught:-** The subjects taught included the three Vedas-Rigveda, Sama Veda and Yajurveda and possibly the Atharvaveda. All the other subjects like military science, astronomy, logic were based on the Vedas.

4) **Social Flexibility:-**The basis for caste was not social hierarchy but ability. ⁶ This is justified by the Rig Vedic hymn that a single family has a weaver, a poet harrower etc.

5) **Women given education:-** Women like Maitreyi and Gargi became reputed scholars and composed Vedic rhymns.⁷

⁴ Encyclopedia Britannica on Rita (<https://www.britannica.com/topic/rita-Hinduism>).

⁵ Like the Yoga which energizes both the mind and body.

⁶ 'I am a poet, my father is a physician, and my mother is a grinder. Earning a livelihood through different means we live together' (Rig Veda IX.112.3).

⁷ Altekar, A.S., *Education in Ancient India*, Nand Kishore & Bros., 1944, p.208.

6) **Gurukul System** - The term Guru⁸ is derived from two words meaning repeller of darkness in a combined form. the system of hermitage presided by guru was the mode of education and located in a secluded and lonely place.

The teachers of reputed places like Takshila enjoyed complete autonomy over the syllabus and students along with social respect and a lot of other types of privileges like exemption from taxes and right to perform rites. The system specifically focused on moral and spiritual aspects of life.

The main thing is that the practical part of life was considered important and convocations and examinations were considered superfluous. The famous gurukuls were Takshashila, Nalanda, Valabhi and Ujjain in North India and places like Kanchi, Tanjore and Madurai etc. in South India.

7) **Foreign influence :-** A lot of foreign influence on the Ancient Indian System of education can be seen. There are several things common between the Parsi Zoroastrian holy book Zend Avesta and the Hinduism .Rigveda and the Boghazkai⁹ inscription in Asia

⁸ In Sanskrit, the primitive word forms 'Gu' and 'Ru' mean 'Darkness' and 'Enemy' respectively.

⁹ one of the inscription proves that the Aryans are from Central Asia is Boghazkoi (Asia Minor ,Turkey) Inscription and mentions Indra , Varuna , Agni and Nasadiyas who are Vedic Gods .Although , THERE IS a degradation of the Vedic Gods in the Avesta but this proves that Vedic

Gods were worshipped till 1400 BC in Asia Minor. (Inflibnet – the Pre Vedic ASVINS).

(https://www.google.com/url?sa=t&source=web&rct=j&url=http://shodhganga.inflibnet.ac.in/bitstream/10603/104527/22/22_chapter%252014.pdf&ved=2ahUKEwiUlfax7_fbAhVQeysKHRcYA5QQFjAGegQIAxAB&usg=AOvVaw3WY4PsCjA8r_gE4N6LRqVt), accessed on 10th July 2018.

Minor have been seen several cultural similarities are there in common-names of Gods like Indra, Varuna and Agni.

The Ancient Mesopotamia, their religion and religious life was an integral part of education,¹⁰ we can observe in influence of the same type in the Aryan civilization of India. The foreign influence on Taxila can be directly seen from the Graeco Roman artifacts found there at Bhirmound, Sarisukh and Sirkap and around as per John Marshall, in his(A Guide to Taxila). The Greek crafts and arts were taught after Alexander's invasion as evident from the archaeological excavations.

Brahmanical Education

- 1) It indicated worldly affairs and focused upon them.
- 2) Gurukul systems gained currency.
- 3) It stressed on – personality development ,truth, peace and overall development of the society.¹¹

The Buddhist system (Monastic order)

The Buddhist system (of education) emerged in a form of reaction against Brahmanism in about 06th century BC.¹² The main agenda was to challenge the dominance of Brahmins in the educational and ecclesiastical spheres.

The common people including the women and other sects were included in the formal system of situation. It changed its form after the death of Buddha Hinayana and Mahayana. But Hinayana gradually lost its ground and Mahayana gained popularity in India and abroad.

¹⁰ Kuiper, Kathleen, *The Britannica Guide to Ancient Civilizations, Mesopotamia the worlds' earliest civilization*, Rosen Educational services, 2011, p.192.

¹¹ Altekar, A.S., *Education in Ancient India*, Nand Kishore & Bros., 1944, p.13.

¹² Sharma, R.S., *Ancient India A Textbook for Class XI*, NCERT, June 1981, p.60.

It focused on the concepts like Nirvana sorrowful nature of life etc. It also discussed the concepts like middle path and the ways to get out of the sorrowful nature of life.

Besides all three features there were regional centres of education like Varanasi in the north and Nagarjunkonda in the Deccan, Kanchi and Tanjore in the far south, which were regionally unique. But several regional states emerged in different places in different parts of India, In south several temple towns emerged.

The rise and fall of empires also influence the academic atmosphere and the influence of Vajrayana form of Buddhism is clearly visible in the Nalanda University out of form and Prajnaparamita (image of a Vajrayana Goddess) indicates a deep influence.¹³ Similarly the influence of Buddhist (Hinayana) form may be seen in few places like Valabhi in Gujarat.¹⁴

The Philosophy and ideology behind Ancient Indian Education.

- i) The teacher or Guru was comparable to God or even greater than the three gods.

It has been said-

“Gurur Brahma Guru Vishnu

Gurur Devo Maheshwarah

Gurur Sakshat Parm Brahma

Tasmay shree guruwe Namah.” ---¹⁵

¹³ Property : Excavated Remains of Nalanda Mahavihara, Submitted by state party-India, Agency – Archaeological Survey of India, Nomination Dossier, Appendix03 -Inventory of sculptures: Metal Art, p.16.

¹⁴ Apte, D.G., *Universities in Ancient India*, pp.44-46.

¹⁵ The Guru Gita, Shloka No.32, Uttarakhand section of Skanda Purana .

Which clearly meant that the Guru enjoyed special position in the life of disciple.

- 2) The education system was guided by the fact – ¹⁶“Rite Gyanan na mukti” -there is no liberation from the cycle of birth and death without knowledge.¹⁷

So, there was a spiritual element in Ancient India which was a decisive part of the whole system.

Due to the huge literature produced, presently the scholars are studying the Buddhist texts (ancient) from both the nations (India and China). The scholars are from India and from Beijing University, China to form an Encyclopedia of cultural contacts.¹⁸ So, we need to carefully transliterate and literally evaluate the Pali language and other changes in the texts.

The mythology of head donation by Buddha and Persian influence confront each other for the home ‘Bhirmound’ (heads of servants or head of students) in corrupted form of Pir Mound , regarding the naming of the oldest site at Taxila.

The account of Fa-Hien and Hiuen –Tsang continuously show the rise and fall of Taxila. Hiuen – Tsang, the Chinese traveller who visited India during the 7th century AD is of the opinion that Taxila had lost its former glory.¹⁹

The reasons for the decline and downfall of Taxila are surveyed in detail by the historians, which has several views and opinions, out of which the Huna infusion theory in

¹⁶ From the Hiranyakeshiyasakhasruti (A non extant Vaishnava text). The phrase is attributed to in the Setumala Commentry on the Harivakya sudha Sindhu at 115.7.

¹⁷ .Sanskrit translation of Rite Gyanan na Mukti.

¹⁸ Ministry of External Affairs- Encyclopedia of India – China cultural contacts (<http://www.mea.gov.in/in-focus-article.htm?23520/Encyclopedia+of+IndiaChina+Cultural+Contacts>).

¹⁹ Marshall, John, A Guide to Taxila, Calcutta Superintendent, Government. of India, 1918, p.18 .

the most common and accepted, that the university was destroyed by them in the 05th – 06th centuries AD.²⁰ The Buddhist religion , which China learnt from Taxila,²¹ however did not remain exact. Several other Chinese religions like Taoism . Confucianism etc. influenced it. Nevertheless , Buddhism from Taxila increased Indian international prestige and honour.²²

Universities in Ancient India

<u>ANCIENT UNIVERSITY</u>	<u>LOCATION</u>
TAXILA	GANDHARA MAHAJANPADA
NALANDA	MAGADHA MAHAJANAPADA
VALABHI	SAURASHTRA PENINSULA
VIKRAMSHILA	MAGADHA MAHAJANAPADA ²³

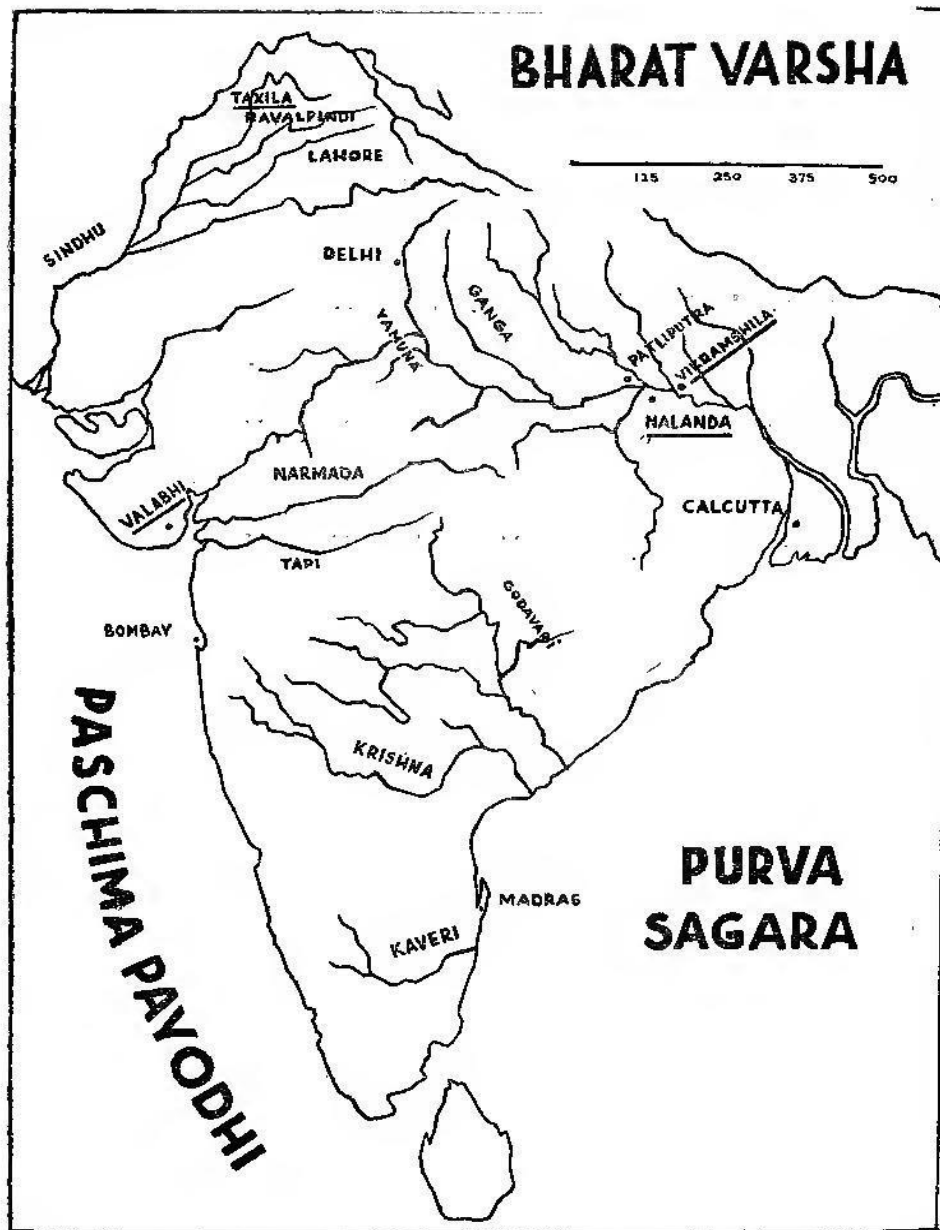
²⁰ Apte, D.G., *Universities in Ancient India*, p.22.

²¹ Porter, Bill, *The Silk Road: Taking the Bus to Pakistan*, Counterpoint Publications, CA, 2016.

²² *Buddhism in Current China –India diplomacy* ,Journal of Current Chinese Affairs ; China Aktuell [Vol 45, No 3 \(2016\)](#).

²³ Apte, D.G., *Universities in Ancient India*, MS University Baroda, Publication year unknown.

Figure.1



UNIVERSITY CENTRES IN ANCIENT INDIA

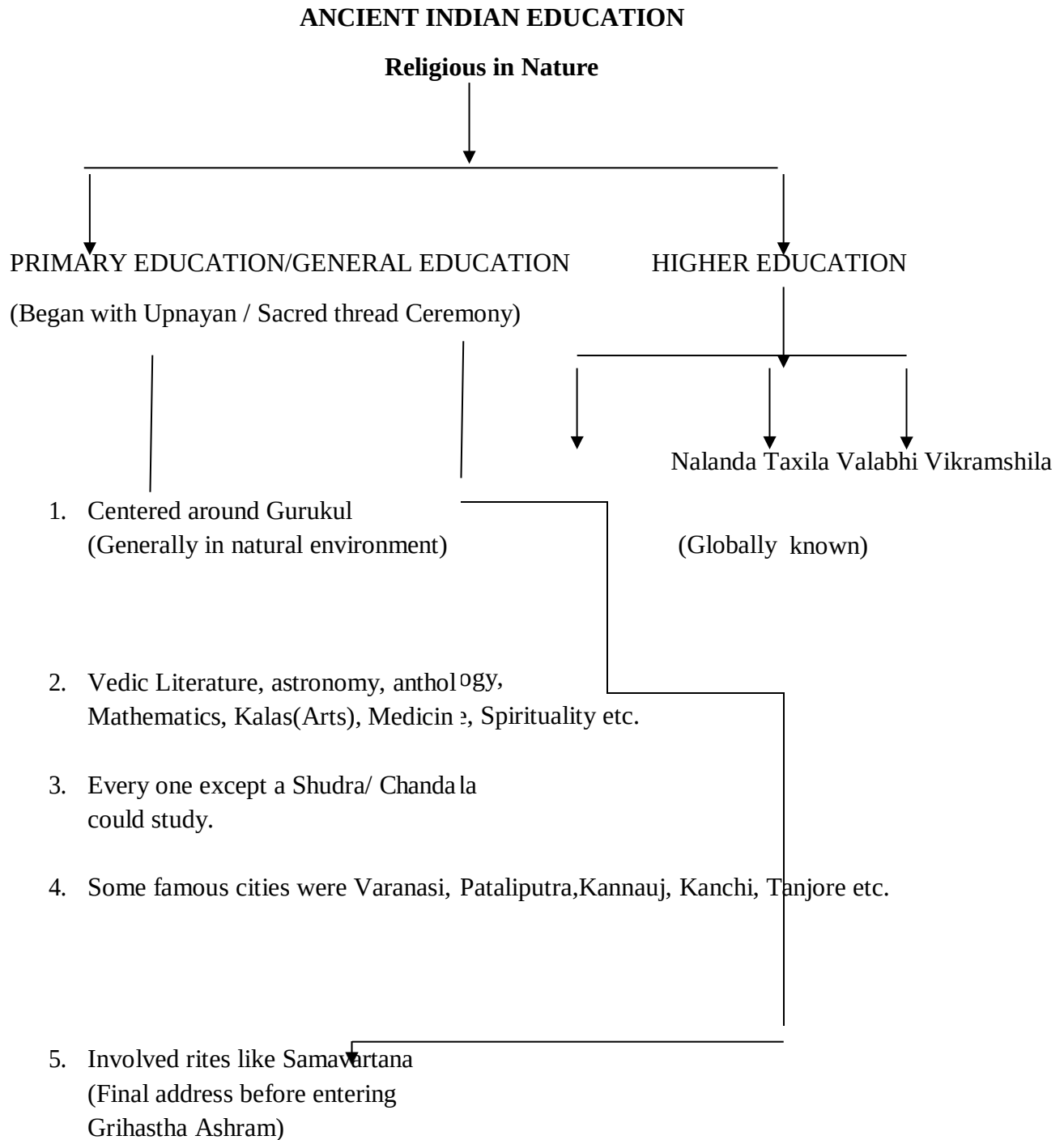
Figure.2



The Dharmarajika Stupa

Courtesy : UNESCO Website

Table showing a general overview of Ancient Indian Education



An imagination of the Vedic Gurukula

The Gurukul was a type of school in ancient education system. The gurukul system is an ancient learning method. Gurukulam has existed since the vedic age. Their main motto is to develop the knowledge and they were highly focused on education. The Gurus train their students with meditations, yogas and other standards.

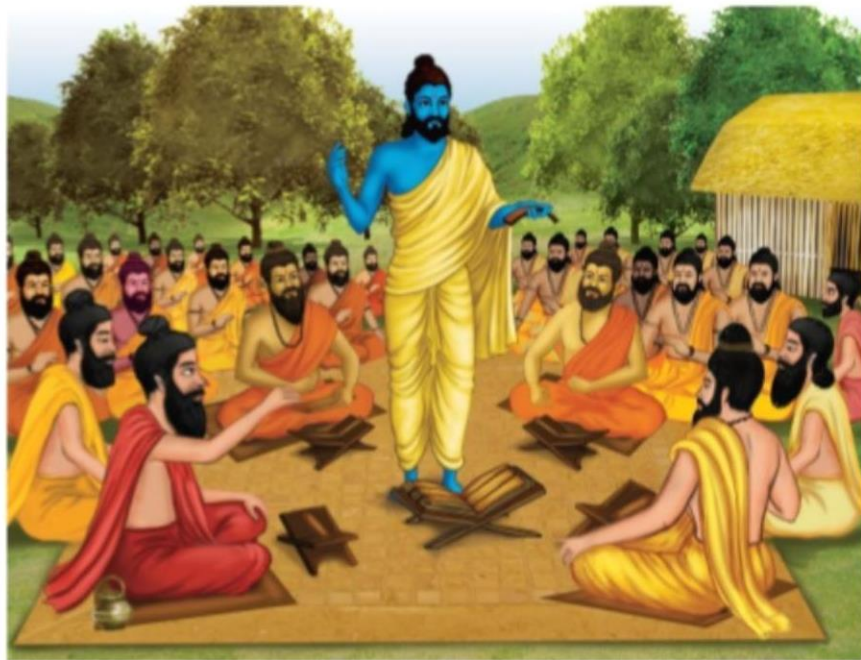


Figure.3

A General Overview of the Vedic Gurukul.

(Courtesy : Google Images) <http://www.edubilla.com/blog/the-gurukul-system-of-education/>

Research Methodology

The research will progress through various types of sources, primary and secondary. It will take help of the archaeological excavations at Taxila by Alexander Cunningham, John Marshall and also of the studies by scholars like D.G. Apte, A.S. Altekar and the well known Pakistani Archaeologist Salman Rashid etc. It will try to access the Ancient Indian system of Education and its high standards involved the complete manifestation of its students in his personal and social welfare in general.

About Taxila

Taxila, the region's capital, was the seat of a famous university, says Ahmed Hassan Dani in his work, the Historic city of Taxila. He further explains that various subjects like astronomy, Mathematics, Medicine, Sanskrit and Prakrit grammar were taught. He went on to add that Taxila was a politico-economic center and a place of cultural conglomeration.

Taxila was a universal education center by 6th century BC and imparted education in military science, medicine etc. apart from the traditional scriptures. Education was considered too sacred to be sold for money and the university got generous grants from the Royal family, common and rich people. There was a strong ethical code prevailing within the private gurukuls with an ideal teachers students ratio. The poor students who couldn't afford to pay the tribute to guru had the option of being a domestic helper in day and a student at night.

Since India has always been prone to invasions from the north west, political instability prevailed all around and we face the challenge of studying its impact on the education system of Taxila. 'Brahmi', the indigenous script, was reduced and was replaced

by 'Kharoshthi' as a result of Persian influence. Greek training of sculpture and other art forms, including its indigenous effects have also been studied since Mahayana Buddhism spread to China through this route, we may see a huge Buddhist influence. Hiuen Tsang has mentioned that Taxila had lost its grandeur by his time.

The destruction of Taxila came mainly by the marauding and vandalizing Huna tribes who, by their constant invasions put an end to this great intellectual centre. We must note that Taxila was the centre of higher education and specialized studies, which taught several 'Kalas' (Arts) and several other famous and important branches of knowledge. Some of the famous Alumni of Taxila were- Prasenjit (the king of Koshala), Chanakya (the prime minister and guide of Chandragupta Maurya), Jivaka (the famous physician of Ayurveda), Charak (famous physician of Kushan times), Panini (the famous Sanskrit grammarian).

Being a world heritage site we must know various aspects of its history- its nomenclature, the prime reasons for its popularity, Alexanders' experience at Taxila, Buddhist reference, Alumni and its socio-cultural importance in various ways like literature, art and music etc .

CHAPTER PLAN

The dissertation is organized into four chapters – First Chapter deals with the general overview of Ancient Indian Education. The second chapter deals with Taxila as a centre for learning including various aspects like growth and development of the university, the various cultural influences like Buddhism, Greek influence, academic atmosphere and notable alumni etc. The Third chapter deals with the archaeological heritage ,its preservation and conservation efforts. The Fourth Chapter is a concluding chapter.

Literature review

Taxila has drawn the attention for its three fold prosperity – economic, cultural and as a learning centre and there is no dearth of various types of literature available on it – from mythological, foreign accounts, religious, archaeological and a number of books and articles authored by Indian and Pakistani writers .The important ones are described below.

The Mahabharata and the Ramayana mention the place, including the Vayu Purana, in an eulogical manner. The Buddhist Jatakas like Telmushti, Telapatta and Sushima Jatakas also praise the city as a learning centre. The travel records of Hiuen Tsang and Fa-Hien narrate the decline of the city.

The main secondary sources are : Extracts from ‘The Dawn’, Pakistani English Daily, Education in Ancient India by Hartmut Scharfe and AS Altekar respectively(separate books). Apart from this, several other sources like an article by S. Srikanta Shastry – Taxila : an Ancient Indian University, UNESCO reports and documents have been consulted.

Web resources and personal interview have also been used to a considerable extent.

So far, only archaeological and cultural aspects have been highlighted, the recent discovery of 'Bakhshali Manuscript ' about the mathematical talent has raised new questions and issues.

The religious sources try to portray the single academic aspect and the environment of education, including mythological tales and the secondary sources have tried to analyze it critically. We need to pay attention to Taxila because after independence and partition, its unique features, especially academic, are neglected and reviving it like Nalanda, may re strengthen the cultural ties between India, Pakistan and China and can promote world peace.

Chapter II

TAXILA UNIVERSITY

The learning centre of Taxila was the earliest one in the Indian subcontinent and as per some scholars, in the whole world, as its beginnings are traced to 700 BCE.¹ But, one fact is certain that it had gained name and fame by at least 5th and 6th century BCE as a centre of education in the whole Indian Subcontinent.² Taxila is mentioned as an educational center in the Jataka Tales³ Telmushti,⁴ Telapatta⁵ and the Susima Jataka tales. The roots of Taxila may be traced from the two great Indian epics- Ramayana⁶ and the Mahabharata.⁷

Ramayana was the first epic to give a vague reference of Taxila, where it mentions, prince Bharat as the founder of the city of Taxila, who had appointed his son Taksha as the ruler of the Gandhara territory (of which Taxila was the capital). The Mahabharata mentions Taxila, as ruled by emperor Parikshit, mentioned as the son of Arjuna (after the Pandavas went for their heavenly abode).

Besides all these, several foreign historians mention Taxila in their works. They mention the economic prosperity of Taxila at the time of Alexander's invasion. For example Arrian and Strabo⁸ the Greek historians also give much importance to the

¹ Apte, D.G., *Universities in Ancient India*, p.8.

² www.old.aicte-india.org/downloads/ancient.pdf, accessed on 26th June 2018.

³ Rouse, W.H.D., *The Jataka*, Vol. 2, [1895], at, [sacred-texts.com](http://www.sacred-texts.com).

<http://www.sacred-texts.com/bud/j2/j2105.htm>, accessed on 26th June 2018.

⁴ Law, B.C., *Geography of Early Buddhism*, pp. 49-50.

⁵ *Ibid.*, p.4.

⁶ Dutt, Romesh C., *The Ramayana : Epic of Rama, Prince of India*, p.162.

⁷ Sharma, Shubra, *Life in the Upanishads*, Abhinav Publications, New Delhi, 1985, p.42.

⁸ Marshall, John, *A Guide to Taxila*, Calcutta Superintendent Press, 1918, p.2.

economic prosperity as Taxila was fortunate to enjoy the fertile land between Indus and the Jhelum rivers.

REASONS FOR ITS POPULARITY

There were several factors behind the rise and growth in the name and fame of Taxila as a world reputed centre of learning. The important factors are analyzed below:

1. Geographical factors – The Geographical factors like the location of Taxila near the trade route connecting Asia and Europe was ideal for peaceful academic atmosphere. The rocky Hathi range, secluded area, where the work of teaching went on. So the area provided infusion (with the world cultural environment) and seclusion at the same time.

2. Economic Factors - Location in the fertile land and the rivers, Indus and Jhelum, made it appropriate for abundant agricultural production and the location near the trade routes connecting India, Central Asia and Europe, made it a trading centre.

3. Political Factor – Since Taxila had been a political capital of the son of Bharata (Taksha), of Arjun's Son (Parikshit) and of the Kushanas and Indo Greeks and had faced politically unstable situation from the time of its establishment, the education was naturally effected. There were both, positive and negative effects. The positive being, a multicultural environment and the negative being anarchy in the academic atmosphere.

4. Cultural factor - The cultural diversity, as a result of political and geographic factors provided a world outlook. So, students from Asia minor, China, far off regions in India came to Taxila for higher education. It may be noted that the Chinese people revered Taxila as a Centre for propagation of Mahayana Buddhism.

5. Religious Factor – The Mahayana form of Buddhism, which propagated itself from eastern India to Northwestern India, went to Taxila first, before spreading out to China and Central Asia and becoming a global religion.⁹

The Buddhist remains indicate, and the literary sources mention Taxila as a famous place for learning Buddhism. The examples of Gandhara school of Art, the Dharmarajika *stupa* and monasteries at Jaulian etc. are fine examples of Buddhist influence over the region. The teaching of Greek culture and art at Taxila is the greatest example of cultural influence and diversity. Vincent Smith, in his book 'A history of early India', has mentioned Taxila as a university town.¹⁰ In the mythological world, king Janmejaya had performed a great Yajna, to destroy the snakes. Whatever may be the truth, it is clear that Taxila was influential in the politico – economic and socio-religious atmosphere of the world in general and Indian subcontinent as a whole.

METHOD OF TEACHING

The method of teaching and learning at Taxila was based on traditional Ancient Indian system of Gurukul education. Religion and ecclesiastical concepts played a pivotal role in it. The concept of 'Guru Shishya Parampara' or teacher – student relation is very precious and particular. It educated a complete spiritual transformation of the disciple beside making him knowledgeable. The process of education involved many rites and rituals Upnayan (sacred thread) and Bhikshatan (begging for food by students to prevent the feeling of development of ego).¹¹

⁹ Porter, Bill, *The Silk Road: Taking the Bus to Pakistan*, 2016.

¹⁰ Smith, Vincent A., *The Early History of India, From 600B.C. till the Muhammadan Conquest*, Oxford, 1914, p.62.

¹¹ Altekar, A.S., *Education in Ancient India*, Nand Kishore and Bros., 1944, p.13.

The original method of teaching was depended on oral sources. It involved a lot of didactic concepts all over India and abroad. The rise of Buddhism and the influence of multiple cultures influenced the teaching methodology and academics. For example, after the first popular influence was that the Graeco –Roman culture deeply influenced the Gandhara culture there, after Alexanders’ invasion. Greek art and craft, including Buddhist Art and Buddhist studies. Different departments had different reputation levels. The department of Medical sciences was the most famous of them. The students practicing medicine were strictly supervised by an expert for a long time and, same was the case with other departments. The students were taught in groups of 15-20 by the subject teachers, under whom they wished to study. In the spiritual tradition of Ancient India, the knowledge received from the teacher had to be analyzed in three different ways. First involved general listening or ‘Shruti’. The second level was to remember and repeat it. The final stage was to analyze its causes and co-relate it with other topics.¹² It has been asserted that the teachers treated all the students equally, regardless of their family background.¹³ There is a reference that a student from royal family was beaten by using sticks.

Since the teachers there taught independently and no examination was conducted in the formal sense of today, the teachers ensured that student has mastered the Chapter before proceeding on to the next. In this way, the study period of different students was different, as they took different times. No degrees or certificates were granted as in those days, education was considered as a reward/ enlightenment in itself. The birch bark/

¹² *Indian Educational System : An Overview of the Ancient Indian Education*, pp.9-10., http://content.inflibnet.ac.in/data-server/eacharya-documents/548158e2e41301125fd790cf_INFIEP_72/77/ET/72-77-ET-V1-S1_1_.pdf, accessed on 27th June 2018.

¹³ Altekar, A.S., *Education in Ancient India*, Nand Kishore and Bros., 1944, p.28.

Bhojpatra leaf was used instead of paper to write and this has been confirmed in the latest research project by Oxford University regarding Taxila.¹⁴ The students admitted, could be of any social background except a Chandala¹⁵ and Shudra and there was no rigidity in the education system. There were Brahmins learning military science and Kshatriyas learning the Vedas and Vedic literature even, students from Central Asia, China etc. attended the University.¹⁶

We must remember that this centre of learning produced stalwarts in various fields. In Political Science and Economy, the names of Chandragupta Maurya and his teacher Kautilya are associated with Taxila. In medicine, the physicians like Jivaka, who was the personal physician to the emperor of Magadha¹⁷ and Charak, who was the author of Charak Samhita, the famous text of Ayurveda were associated. In literature and language the names of Panini author of Astadhyayi, a text book on Sanskrit grammar and Vishnu Sharma (the author of the book on ethics and code of conduct). Besides these, there were several authors and famous personalities associated with Taxila.

The name of the exact founder of this University is unknown and its purpose of establishment was to preserve the Vedic Aryan culture.¹⁸ This purpose was successful till the spread of Mahayana form of Buddhism to the North west.

Gradually, it was converted into a Buddhist University and Asoka promoted the growth of Buddhist ideology and culture. Asoka is credited to have built the Dharmarajika

¹⁴ https://www.google.com/url?sa=t&source=web&rct=j&url=https://www.sciencemag.org/sites/default/files/Bakhshali%2520Research%2520Statement_13%25209%252017_FINAL.pdf&ved=0ahUKEwjOtLi4x-3bAhVCuY8KHS8TCMkQFggqMAE&usg=AOvVaw37u5NAhKL98cnYWEUsckxT, accessed on 27th June 2018.

¹⁵ Apte, D.G., *Universities in Ancient India*, p.19.

¹⁶ Altekar, A.S., *Education in Ancient India*, Nand Kishore and Bros., 1944, pp.43-45.

¹⁷ Chen, Thomas S.N. and Chen, Peter S.Y., 'Jivaka, physician to the Buddha', *Journal of Medical Biography*, 2002, p.88.

¹⁸ Munshi, K.M. and Majumdar, R.C., *The Age of Imperial Unity*, Bhartiya Vidya Bhawan, 1960, p.594.

stupa, which contained the relics of the Buddha.¹⁹ Several other Buddhist artefacts have been unearthed and the Chinese including Persian influence is also clearly evident.

SPECIFIC DEPARTMENTS

Some specific departments were the backbone of the name and fame of Taxila. The most famous departments being the department of Medical Sciences and the faculty of Political sciences.

Medical sciences

The name of this department became famous with the association of names like Jivaka (the famous Ayurvedic physician of Ancient India), who spent several years studying Ayurveda. Although, he belonged to a family of humble origins, he rose to the position of the chief physician to the emperor of Magadha. The medical science of Ancient India was Ayurveda, which was based on herbal treatments and the fundamental belief that all the three substances -vaat (air or gas), pitta (digestive enzymes) and cough should have a perfect balance in the human body.²⁰ The great Sanskrit grammarian Panini also wrote his famous book on Sanskrit Grammar, the Ashtadhyayi, when they were associated with the famous University.

It was considered to be a matter of pride and honour in those days to have received education at Taxila. The rise and growth of this university town has several other departments and study centers, which were reputed even in foreign lands like the department of Buddhist studies, which was a pilgrimage for the Chinese people.²¹ Great

¹⁹ Singh, Dr. Anuradha, ' *Space and Culture* ', India, 2014, 2:2.p.46.;

<https://www.google.com/amp/s/www.dawn.com/news/amp/1260048> , accessed on 27th June 2018.

²⁰ Lad, Vasant Dattatray, *Textbook of Ayurveda A Complete Guide to Clinical Assesment Volume Two*, The Ayurvedic Press, Albuquerque, New Mexico, 2007, p.45.

²¹ Sen, Tansen, 'The travel records of Chinese Pilgrims Faxian', Xuangzang, and Yijing, p.25 at

warriors and military stalwarts were also produced at Taxila. King Prasenjit of Kosala and Jyotipala, the famous army commander, were all products of Taxila.

So, it is interesting to note that on one hand, Buddhist studies (including the message of non-violence) and on the other hand, Military science, both were excellently taught and produced great personalities. Overall, the wide range of subjects taught at Taxila included the vedas (Rigveda, Yajurveda, Samaveda and Atharvaveda). The number of taught vedas mentioned is only three, without Atharvaveda,²² but it cannot be possible because for becoming a royal priest (Rajpurohit), knowledge and mastery over Atharvaveda was necessary.²³

COMPARISON WITH NALANDA

Very often, when we talk about the education system at Ancient Taxila University, our mind naturally compares it with Nalanda, Valabhi or Vikramshila and several other centres of education in Ancient India.

We must know the differences among them, to distinguish the unique features of each of the centers of education.

Nalanda and Taxila – Key differences

There were some notable differences between Nalanda and Taxila which can be justified from the following facts.

Infrastructure

Nalanda University had a large campus, with all the facilities like monasteries, religious halls and assemblies, hostels for the students and residences for teachers and rich

http://afe.easia.columbia.edu/special/travel_records.pdf, accessed on 27th June 2018.

²²Apte, D.G., *Universities in Ancient India*, p.12.

²³Ibid., p.12.

libraries. No such infrastructure has been reported from Taxila, where the students were guided by the respective individual ‘Acharyas’ or teachers of their disciplines.²⁴ It was probably destroyed due to lack of care and maintenance.

Disciplinary Variation

Taxila was mainly known for the faculty of Medical sciences, while Nalanda was famous for Buddhist studies. Besides this several other disciplines were taught at both the universities like logic, Sanskrit, grammar, Vedas, Astronomy and Astrology etc.

²⁴ http://shodhganga.inflibnet.ac.in/bitstream/10603/52333/10/10_chapter%201.pdf
Historical background of university libraries in Ancient India, accessed on 27th June 2018.

Chapter 1, 1.3 Review Of Literature University Libraries in Ancient India, p.5
https://www.google.com/url?sa=t&source=web&rct=j&url=http://shodhganga.inflibnet.ac.in/jspui/bitstream/10603/188953/7/07_chapter%25201.pdf&ved=2ahUKEwiy993yv_rbAhXKvY8KHaasDHYQFjAAegQIABAB&usg=AOvVaw3mN7d3xVTklGOEu-wXSZqj, accessed on 28th June 2018

Taxila was much older than Nalanda

Taxila University flourished and escalated between 700 BC to about 5th century AD and the time period of Nalanda was from 5th century AD to 12th century AD, when it was destroyed by the Turkish invaders. ²⁵

Other Centers of education

Several other centres had their own unique features of education like –

- 1) Valabhi (Gujarat) was famous for Hinayana Buddhism. ²⁶
- 2) Vikramshila (Bihar) was a centre for Vajrayana form of Buddhism. ²⁷
- 3) Kanchi was a monastic seat of education in south India²⁸ and Varanasi was the seat of monastic education in North India.
- 4) Thanjavur/Tanjore was a very famous education centre for temple studies in south India. ²⁹

²⁵ Apte, D.G., *Universities in Ancient India*, pp. 21-22 and 43.

²⁶ Apte, D.G., *Universities in Ancient India*, p.44.

²⁷ <https://en.m.wikipedia.org/wiki/Vikramashila> (See the section on Tantric preceptors). (28th June 2018)

²⁸ Chatterjee, Suhas, *Indian Civilization and Culture*, MD Publications Pvt Ltd, New Delhi, 1998, p.410; http://shodhganga.inflibnet.ac.in/bitstream/10603/56079/12/13_chapter4.pdf, p.100, accessed on 29th June 2018.

²⁹ Altekar, A.S., *Education in Ancient India*, Nand Kishore and Bros., 1944, p.103.

And http://shodhganga.inflibnet.ac.in/bitstream/10603/25597/10/10_chapter%204.pdf , accessed on 29th June 2018.

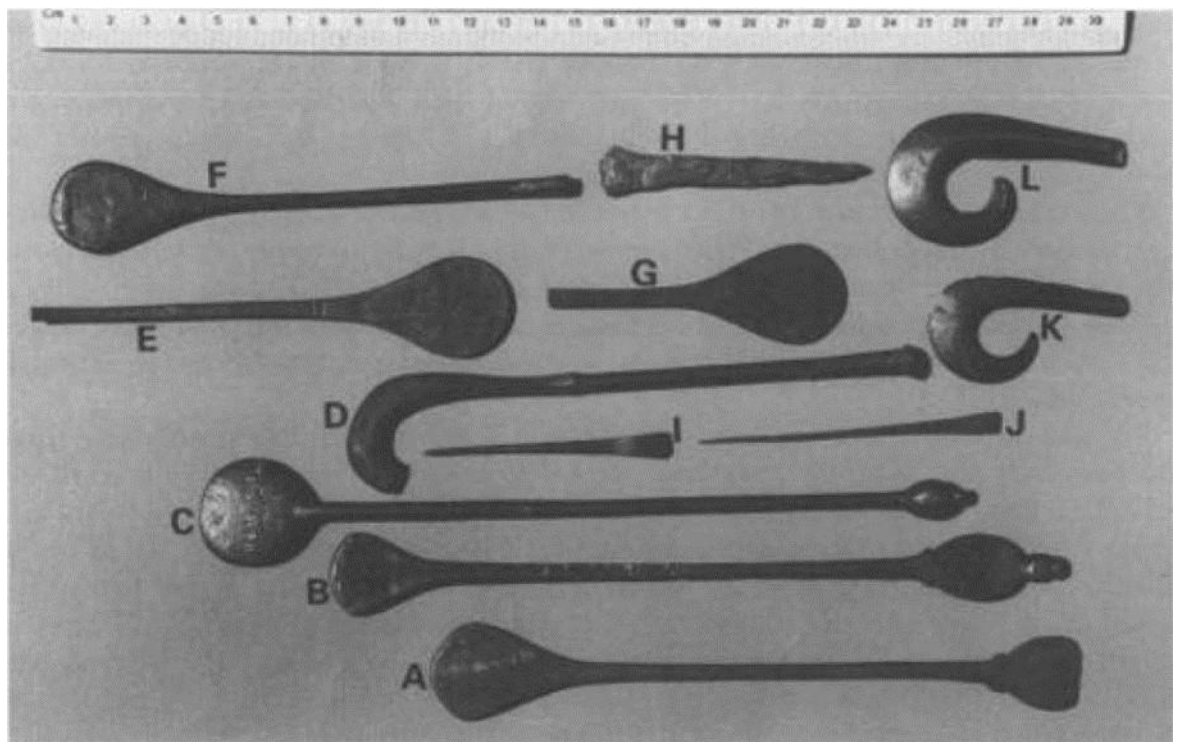


Figure 4: Surgical Instruments At Taxila

Courtesy: www.researchgate.net, Researchgate article -Narayana and Thrigulla Tangible evidence of Surgical Practice in Ancient India.

https://www.researchgate.net/publication/268496436_Tangible_evidences_of_Surgical_practice_in_Ancient_India, accessed on 29th June 2018.

Nomenclature

The city of Taxila was named and remanded several times throughout the course of its history. The nomenclature in itself has several aspects mythological, historical and linguistic connotations.

Mythological

Mythology says that the city of Taxila was built by Takshaka serpent (nag), whom Janmajeya wanted to destroy. Janmajeya was the descendent of Parikshit (son of Arjuna's son Abhimanyu) and their enmity is negotiated and converted into peaceful mutual understanding by Astika.³⁰ This complete story is found in the Mahabharata and it seems that different scholars date this event of king Parikshit differently. Wetzel dates into 12th - 11th centuries BC³¹ and HC Raychaudhuri to 9th Century BC.³² In the Ramayana also, the city of Taxila is underlined as being ruled by Bharata's son Taksha and built by Bharat (brother of lord Rama himself, who was an incarnation of lord Vishnu).

Historical and Linguistic

As per early Christian legend, Taxila was visited by³³ Apostle Thomas during the Parthian period, the city was also visited by Apollonius of Tyna (1st century CE), whose biography (by Philostratus) described Taxila as a fortified city, laid out on a symmetrical plan and compared it in size to Ninveh of Ancient Assyria.³⁴

³⁰ Michael Witzel, *Tracing the Vedic dialects in Dialectes dans les litteratures Indo-Aryennes* ed. Caillat, 1989, pp. 97–265; Raychaudhuri, Hemchandra, *Political History of Ancient India*, Cosmo Pub., 2006, pp. 15 and 29-30; Michael Witzel, *Tracing the Vedic dialects*, 1989, p.141; Misra, V.S., *Ancient Indian Dynasties*, Mumbai: Bharatiya Vidya Bhavan, 2007, p.278; Vaidya P.L. and A.D. Pusalkar, "The Mahabharata: Its History and Character" in S. Radhakrishnan (ed.) *The Cultural Heritage of India*, Vol.II., The Ramakrishna Mission Institute of Culture, 1962, (reprint 2003). p.60.

³¹ Ibid.

³² Ibid.

³³ F.A.D. Cruz, *St. Thomas the Apostle in India*, Hoe and Co., Premier Press, 1922, p.14. ; Bhatti, Wajid and Riaz, Farhan, ' St. Thomas in Taxila', p.6.

³⁴ www.britannica.com/place/Taxila., accessed on 29th June 2018.

As per the Buddhist travellers, Fa-Hien and Hiuen-Tsang and as per the literal meaning of Sanskrit language, the city means “cut-Rock”.³⁵ Since the teaching and learning activity was mainly carried out near the rocky Hathial range, the name must have sounded appropriate to the Ancient Indians. Three main sites – Bhir mound, Sirsukh and Sirkap have their own foundation stories. Bhirmound was built around 6th - 5th centuries BC and Sirkap around 180 BC. Sirsukh was built around 80 AD.³⁶

The Greek style of accent gave the city its present name Taxila, which was actually Takshasila in Sanskrit. The ruins of Taxila as a centre of learning, administration and trade made its name very famous. It was the most visited tourist historical site of Pakistan in 2004. Presently, in Pakistan the city is called ‘Texla’, which is the corrupt form of the word Taxila, however the city has been archaeologically neglected by the government of Pakistan to a great extent.

As per Puranic Hinduism, the ‘Takshas’ were a special form of serpents who could assume human form at their own pleasure. In Ptolemy’s geography, Taxila was called Taxiala.³⁷ So, the name and nature of Taxila kept on changing several times in the course of its long history and reputed city continued to earn a global name in educational field at least, in around 5th century AD. However, as per Kosambi, the name Taxila implies a sense of carpenter’s as per the Sanskrit meaning.³⁸

³⁵ Sharma & Sharma (ed.), *Encyclopaedia of Higher Education The Indian Perspective {Five Volumes}* Volume one Historical Survey – pre-independence period, Mittal Publications, 2005, p.9.

In Sanskrit language ‘Taksha’ meant to carve or cut and ‘Shila’ means rock.

³⁶ <https://www.dawn.com/news/366209>, accessed on 27th June 2018.

³⁷ www.speakingtree.in/allslides/chanakya-studied-in-pakistan-where/m-lite, accessed on 29th June 2018.

³⁸ Kosambi, D.D., *An Introduction to the Study of Indian History*, Popular Book Depot, p.122.

CULTURAL FOUNDATIONS

The location of Taxila in a prime geographical area, made it a vibrant cultural centre. In fact, all the cultures of Europe (Greece and Rome), China (Mahayana form of Buddhism, indigenous in nature) and Brahmanism (India) had harmonious confluence at Taxila. The coins³⁹ and stupas, as reported in the memoirs of the archaeological survey of India are a clear cut proof of the diversity of culture which prevailed. The archaeological remains justify the cultural variation, in several ways:

1. The artefacts – multicultural, scientific and artistic like the Buddha images and Dharmarajika stupa.
2. The remains of Gandhara art display a strong Roman influence.
3. The association of Brahmins like Vishnugupta Chanakya etc, along with men like Vishnu Sharma also show a great influence of Vedic Brahmanism.

Moreover, it was also associated with the Bactrian Greeks, the Kushanas, the Indo-Greeks and much before it, the Persians. The process of political anarchy continued and accelerated the cultural transformation. Takshasila, being the entry gate of India was very much prone to foreign attacks. In fact, it was the first to witness cultural change and being a rich province, it was the point of aggression of almost all invaders.

Jayaswal also mentions the political anarchy and the fragmentation of Taxila.⁴⁰ Nearly same view is advocated by Altekar,⁴¹ who described the discipline of the students, including teacher, their code of conduct. Although, mathematics and mathematical imagination must have been in a very initial stage, the fact that the University of Taxila

³⁹ Walsh, C.E.C., *Punch marked coins from Taxila*, Archaeological Survey of India, New Delhi, 1999.
Horace C. Beck, *Beads from Taxila*, Archaeological Survey of India, New Delhi, 1999, pp. 1-22.

⁴⁰ Jayaswal, K.P., *Hindu Polity*, Chaukhamba Sanskrit Pratisthan, 2005, p.251.

⁴¹ Altekar, A.S., *Education in Ancient India*, Nand Kishore and Bros., 1944, p.12.

sowed seeds of initial mathematical attitude in the civilization of Ancient India cannot be denied. The Atharvaveda, from where the roots of presently studied vedic mathematics is derived was also taught and practiced in Taxila, because priesthood and many Ancient seers and priest were associated with Taxila, right from the epic age.

Stages of Development of The University

The rise and growth of Taxila also witness several phases as a university town. The archaeological remains at Sirsukh, Sirkap and Bhir mound must be studied in a careful manner, correlating archaeological data to get a more clear view of the cultural change. The origin of Taxila may be traced back to the period of 700 BC. the informal style of teaching and imparting knowledge by the individual subject experts of that time transformed itself into a learning centre in a gradual manner. The atmosphere and environment around Hathial range, where most of the learning centres were located, provided seclusion and inclusion (with the outside world) at the same time.

However, the nature and character of education at Taxila was dynamic. During the initial period, Brahmanism was dominant but from the 5th century BC onwards the rise and growth of Buddhism in the India subcontinent gradually transformed the nature of education to Buddhist. However, the first major step towards the transformation of the university into a Buddhist centre took place after the coronation of Emperor Asoka as the emperor in 269 BC.

The Dharmarajika stupa, said to have the relics of the Buddha, the stupas at Jaulian, the coins and other artefacts. From this it can be inferred that there was considerable Buddhist influence.

The political anarchy, which prevailed all over the north –west India also influenced the education at the university. The Greek and Roman influence also prevailed to a large extents as evident from the sculptures and artefacts found there. Unfortunately, due to the lack of archaeological evidence, it has become difficult for the archaeologist and historians to exactly define the extent to which the academic atmosphere was influenced by the foreign attacks or even simple contacts. But with the recent discovery of Bakhshali manuscript (mathematical treatise), several wonders may be awaiting to be unearthed about the education system in Ancient Taxila.

The system of education prevailing at Taxila where individual subject experts guided the student has led several scholars to conclude that it was not a university. The Nobel prize winner, Prof. Amartya Sen believes that Nalanda is the oldest Ancient Indian university.⁴² Several other scholars support this claim.

The main difficulty in firmly establishing this claim is insufficient archaeological excavation at Taxila, during the pre- independence point and its transfer to Pakistan after independence and partition of India in 1947. It has suffered irreparable damage as per UNESCO, which has designated (Taxila as a world heritage site in 1980). The government of Pakistan has also neglected site and this has made archaeological excavations difficult.

There is also a claim by western historians that as per Joseph Needham, the Chinese educational system is much old. But, Needham was basically a bio –chemist, so his assumption needs proper investigation before being trusted, and there may be little truth in it. Anyway, it is a matter of Pride that the Bakhshali inscription (a manuscript found near Taxila attracted the attention of Oxford University Researches)for the first use of the term or symbol for the digit zero. So, in the strict sense of the term, Taxila must be called

⁴². <http://www.thehindu.com/opinion/op-ed/Nalanda-and-the-pursuit-of-science/article15519635.ece>, accessed on 29th June 2018.

learning centre of highest studies, as only higher learning and specializations were pursued at Taxila. Although, the definition of a modern university does not fit Taxila, it would not be incorrect if we call it an Ancient Indian university. There is also a controversy regarding the date of its establishment. Some scholars like D. G. Apte say 1000 BC as the earliest date of establishment while others state that 600 BC to 500 BC as the date of establishment. But by recent researches, by using Archaeology and Astrophysics it has been confirmed that the university was established around 700-800 BC and it gained full name and fame by the time of Alexander's arrival in India in 326 BC. This is stated on the basis of the reports taken by the Pakistan experts. The Bakhshali manuscript throws light on five hundred years and the use of zero and their symbols has even provoked further research and probe into the question .

Buddhist Literature

Apart from the above mentioned sources, the Buddhist literature also mention Taxila as centre of learning and parents eager to get their children admitted. The entry was open to married people also there is a reference that a married man is asked by his wife to part off the light at night, when he wants to study.

The Jatakas are full of references to Taxila as a centre of education, so the term university is justified. We must also try to estimate the impact of political instability on the nature of education in a deeper way. After the Persian invasion, Kharoshti replaced Brahmi.

Alexander's experience

The experience of Alexander of Macedonia who attacked India about 326 BC, is recorded and analyzed by several historians like Arrian and Justin in the ancient period and by Pakistan scholars of archaeology and history in the modern period. the most famous Pakistani scholars are Salman Rashid (who investigated Alexander's experiences at Taxila) and Ihsan H. Nadiem who explored the Gandharan culture with special reference to Taxila.⁴³ Nadiem has authored other books like Pothar valley with reference to Islamabad and Taxila .

Let us consider the experience of Alexander, as illustrated by Ihsan H. Nadiem and Salman Rashid:

Alexander was in the west of Indus, but could hear about Taxila glory. the high level intellectuals, Philosophers and sages of Taxila were famous and well known. Alexander conquered Taxila and made it his settlement as per his will. Arrian and Megasthenes were the persons who surveyed Taxila (and wrote their accounts about Taxila).

The work of Megasthenese was Indica, which mentions about the holy men (Sadhus or sages) who roamed the forests in order to control their desires and senses (and also to strengthen their soul). The holy men ate only fruits available in the forest and all of them were pure vegetarians and did not eat flesh and survived on wild fruits and berries in extreme situations.

These holy men were highly revered by the people of Taxila . Theses sages were taken willingly by the people to their homes to serve them with services like massage their

⁴³ Nadiem, Ihsan H., *Taxila in Buddhist Gandhara*, Sang-e- Meel Publications, Lahore, 2015; Rashid, Salman, *Prisoner on a Bus : Travels through Pakistan*, , Sang-e- Meel Publications, Lahore, 2003, p. 176.

bodies and feed them. The businessmen of Taxila never asked them for money, but happily gave them what they wanted.

The holy men performed severe penances like standing naked in the summer season. Alexander had sent his generals to bring the holymen to the Greek camp but one of the chiefs of holy men Mandrinus declined . He told Onesicretes that they were comparable to Socrates, Pythagoras and Aristotle etc. A sage Kalyan went with Alexander to Susa (Iranian town), but was misreported by Megasthenese that he went for the greed of wealth. (While this was incorrect), so Kalyan was defamed at Taxila, while Mandarius was respected for not succumbing to the greedy desires of Alexander. On arrival at Susa and death of Kalyan was a mystery, because he committed self immolation by his own will !!⁴⁴ This was discussed for a long time in Susa. Another remarkable thing is that since Alexander did not want to loose Kalyan, he was assured by Kalyan that they will meet in Babylonia after ten months . It is really surprising to note that Alexander the great died of fever after ten months at Babylonia !! So, the Taxila intellectuals were very virtuous and were able to make accurate predictions and prophecies.

Chinese Pilgrims

Fa- Hien and Hiuen – Tsang

Since Taxila was revered as a centre of Buddhist pilgrimage and learning, many Chinese travellers have left their accounts about Taxila. The most famous travellers were Fa –Hien and Hiuen – Tsang, who came to India. The references of these two travellers are

⁴⁴ <https://en.m.wikipedia.org/wiki/Kalanos> , accessed on 27th June 2018.

found in several important works, related to Buddhism and Ancient Indian History in general.

Record of Fa-Hien

Fa –Hen records that Taxila was a place of Buddhist pilgrimage, mentioned several times in the Jatakas. This was the place where the Buddha donated his head to a tigress so that she could satisfy her hunger.⁴⁵

The Chinese pilgrim Fa- Hien, visited India from 399 AD to 413 AD. Fa Hien came to Taxila in 450 AD. By that time, Buddhism had dominated the entire academic atmosphere. Jawaharlal Nehru in his the Discovery of India has described that (since 02nd century AD), Indo – China relations improved due to Buddhist influence.⁴⁶ In fact, the route of spread of Buddhism passed through Taxila from, about 02nd century AD. We need to understand that Buddhism spread from Taxila to Central Asia, China and Japan.

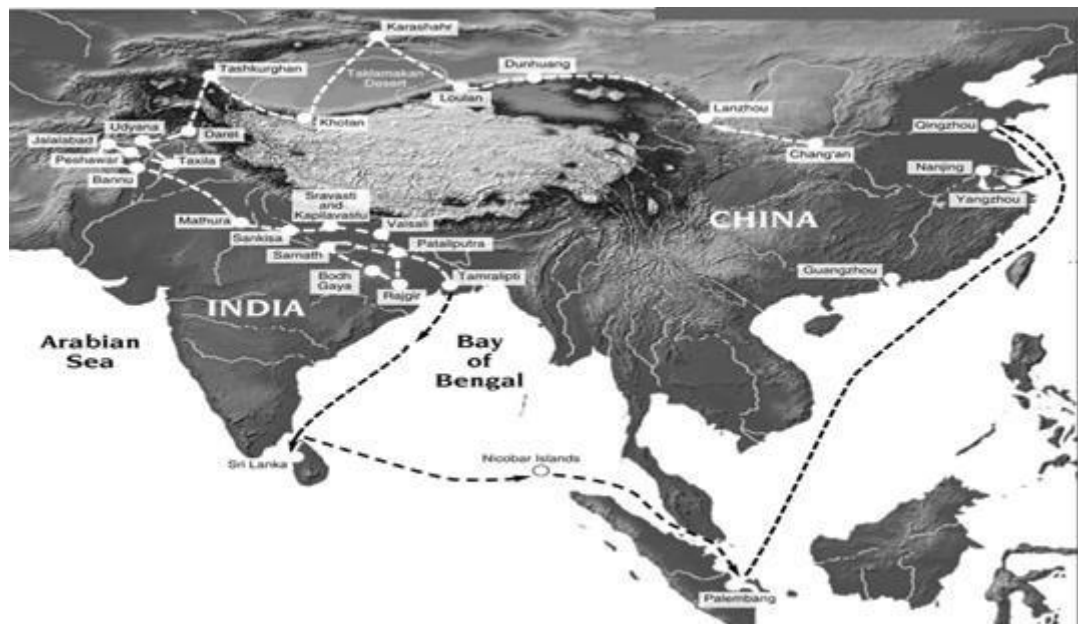


Figure. 5: Fa–Hien’s travel route ; Courtesy: Sen, Tansen, Travel records of Chinese pilgrims, Faxian, Xuangzang and Yijing.

⁴⁵ <https://en.m.wikipedia.org/wiki/Taxila>, accessed on 27th June 2018.

⁴⁶ Nehru, Jawaharlal, *The Discovery of India*, Oxford, 1994, p.192.

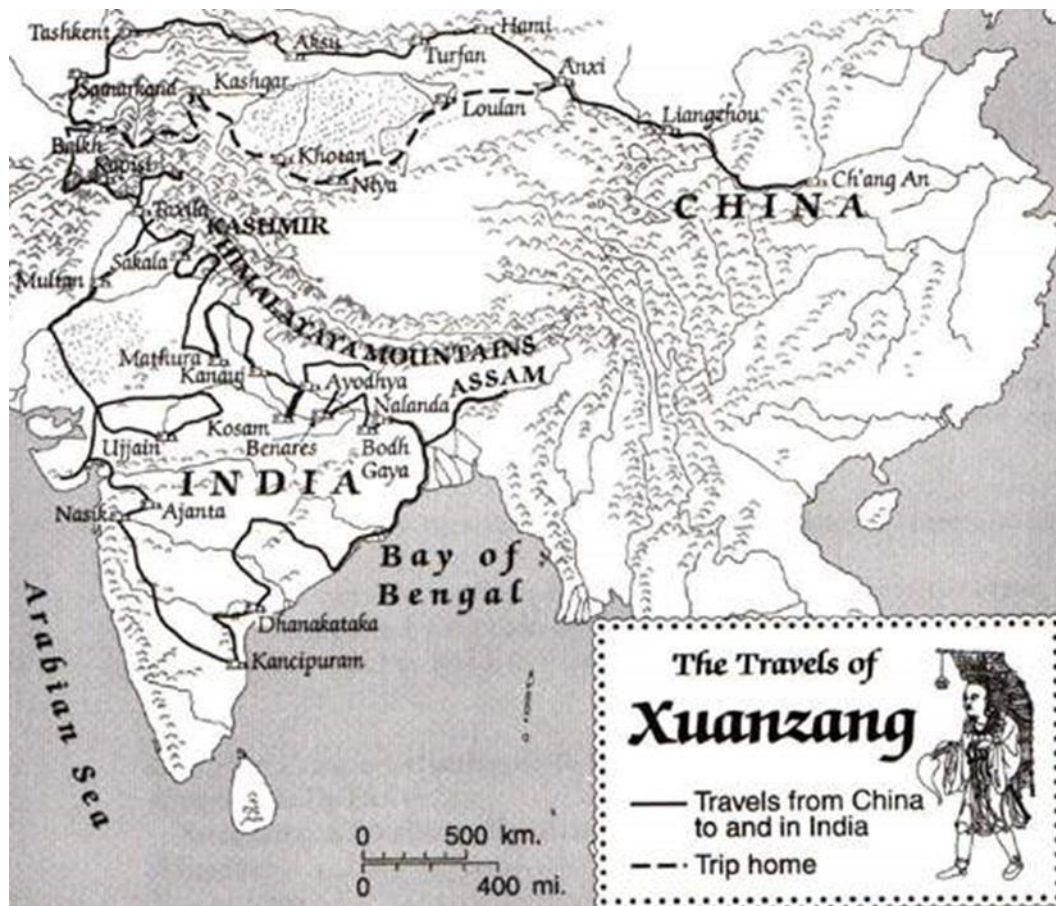


Figure.6

Courtesy: Travels of Hsuan-Tsang -- Buddhist Pilgrim of the Seventh Century
By Irma Marx

(https://www.google.com/search?q=travels+of+hiuen+tsang+irma+marx&tbm=isch&source=iu&ictx=1&fir=6n1PwkPB49wEoM%253A%252CivvFi6IPg51v4M%252C_&usg=_0oVat07EGN44W9rHfPKAC6wCXxY%3D&sa=X&ved=0ahUKEwik_deQiebbAhUVbo8KHS6tDRMQ9QEIUjAH#imgrc=6n1PwkPB49wEoM)

Modern day writers, including Tansen Sen and Several others like Radhakumud Mukherjee, classify Buddhist remains of Taxila, including the archaeologist John Marshall. Buddhism was initiated in a systematic manner at Taxila by Emperor Asoka as he had been the governor of Taxila before his coronation as the emperor as evident from his construction of the Dharmarajika Stupa at Taxila.⁴⁷

⁴⁷ Lahiri, Nayanjot, *Ashoka in Ancient India*, Permanent Black, New Delhi, 2016, pp.66-86.

Alumni of The University

The learning center of Taxila, through its eminent faculty produced stalwarts in various fields like medicine, military science, politics and economics etc. Some of them and referred below:

1. **Chanakya**:- Chanakya or Kautilya (371-283BC) was a teacher and was a product of Taxila . He is said to have been insulted by the ruler of Magadha, Dhanananda. He was a teacher of political science and commanded great respect over his students. Chanakya composed several textbooks like ‘Niti of Chanakya ‘and ‘Arthasastra ‘ which define the level of his high intelligence.

Arthasastra deals with the political economy of an empire and goes in to details of Administration, Kingship and Statecraft. There are total fifteen chapters in it and it also defines the qualities, which should be possessed by spies of the state, ministers and the daily routine of the king. As per Chanakya, and his Mandala theory of polity (theory of circumference), he gives detailed description of the inter- state relations which should be maintained by the ruler of a state. The taxation system should be such that a bee sucking nectar from a flower, which means that it should not hurt the people and the purpose should be to make the state a welfare state and rule the state justly. Apart from the code of conduct for king and administrative officials. Kautilya also mentions the seven limbs (Saptanga theory) of the state –emperor /King, ministers, population, fortress or fortification, land or the area, Army and the most important treasury. His Mandala and Saptanga theories are still important for defence and strategic studies. The Arthasastra also discusses how to upkeep the secret matters of the state and weaken the enemy through diplomatic moves with help of spies.

Arthasastra discusses four qualities which should be in an administrative official or a minister before appointment to a by post in the government. These four qualities are –

Dharmopdha, Arthopdha, Bhayopdha and Kamopdha. These mean dedication to duties and responsibilities, honesty and carefulness in financial matters, checking whether the person succumbs to a threat or a risk and does the work or not and the last one means controlling one's senses while working especially with respect to the opposite sex.

Chanakya or Kautilya is also called the Machiavelli of India (Machiavelli was a great diplomat of Renaissance age Europe from 1469-1527). Till today Kautilya is one of the highly respected diplomats, not only in Indian history but also for the complete world. He was the person who helped and mentored Chandragupta Maurya to establish the Mauryan empire. Chanakya also defines the departments of the state and the officials, also, along with their salaries. The departments were headed by their respective ministers and called Tirthas. Some of the officials were Sitadhyaksha (incharge of Agriculture), Kamramantrik (incharge of mines), Samaharta (collector of taxes) and Shulkyadhyaksha-(collector of toll taxes and cesses). So, Chanakya had multi-dimensional talent and capacity to lay down the formation of the first all India level empire in the Ancient period.

The Arthasastra of Chanakya wonderfully correlates the study of ethics, economics, political science and state-craft along with financial management of the state. So the scope for interdisciplinary research is brought out. Even defence experts agree to the utility of Arthasastra and Mandal theory to protect the state. Chanakya dedicated his complete life for the cause of national welfare and lived the life of a renounced sage free from the lust and any sort of desire, and contributing , academically and intellectually to the country and to humanity as a whole , in the long run .

The king's duties in the interval administrative is three fold –Raksha(protection from external attack), Palana (maintain law and order) and Yogakshema (public welfare). The Arthasastra sought a balance between Artha-dharma and Kama, leading a soul to moksha.

In fact, the whole Arthashastra is an elaboration of true folded truth-‘Sukhasya Mulah Dharmah ,Dharmasya Mulamartha ,Arthasya Mulam rajyam ’(Arthashastra –Chapter 1.1,1.2,1.3).⁴⁸ So ,there can be no prosperity without peace and political stability in a state and only a wealthy person can live righteous life and only a righteous life can bring happiness.

The Mandala theory has been criticized to be a mere geographical concept but in reality it is a concept of Alliance, based on self interest. This theory is aimed at preventing cross border infringement by neighboring states and maintain border peace.

2. **Jivaka** - He too was a product of Taxila and the royal physician of Magadha and also the doctor to Gautam Buddha. There is a saying that he had studied medicine under Atreya at Taxila. He completed a seven year course under the supervision of his teacher and satisfied him. He was a physician to emperor of Magadha Bimbisara(of Haryank Dynasty).

Lord Buddha got treatment for constipation after heavy meal from Jivaka, by a medicated lotus and for leg wound given by his cousin Devdatta. He performed an operation for head ache to remove worms. He also knew Laparotomy which he performed at Varanasi to correct the deformed intestines. Jivaka also cured Bimbisara of Fistula and the jaundice of king Pradyota of Avanti.

There is a famous story about Jeevaka that when his training for the medical courses was over his teacher asked him to go around Taxila and find out and bring a herb which was not medically useful. Jeevaka went around and searched but could not find any herb and returned empty handed.⁴⁹

This teacher became very happy and proud of him and was sure that he would be a great physician and he was correct. Jeevaka was a generous person and dedicated

⁴⁸ Kumar, Neeraj, ‘Building grand strategies with Indian characteristics for rebounding India’, *Journal of Indian Research*, Vol.2, No. 1, January – March, 2014, pp. 4-34.

⁴⁹ IGNOU, EHI- 02, Block- 4, 2007, p.9.

monasteries to his guru Buddha. Jeevaka has been called Jeevaka Kumar Bacha in Pali traditional records. The term Kumar Bacha may have meant servant of royal prince (since Buddha was a royal prince). Jeevaka prescribes washing of wounded intestines with milk, lubrication with ghee and gently placing into their original positions, using a medicated oil. The Pali texts describe each and every instance of Jeevaka's medical procedure in the form of a narrated story. Jivaka is said to be an expert of paedriatics and women cared post delivery and also during pregnancy, lactation etc.

The Ayurvedic doctors in the ancient period were called 'Vaidyas'. Jivaka also treated Ajatsatru who was his Emperor after Bimbisara and the Vinaya Sutra records many examples of Jeevaka's and Buddha's interactions. So, we can rightly call Taxila the propagator of Ancient Indian Ayurvedic medicinal practice, which spread itself to the whole Indian subcontinent as time passed.

Ayurveda also grew with the development of Samhitas (on Surgery) and the growth of Yoga system by Patanjali (who wrote his Sanskrit grammar book Mahabhasya, a commentary on Panini's Astadhyayi). So, Taxila directly contributed to the growth of Ancient Indian Medicine.

3 Chandragupta Maurya

Chandragupta was a student of Taxila university.⁵⁰ He was the disciple of Chanakya who was installed as the ruler of Magadha after dethroning the autocratic and despotic ruler Dhanananda. Although of a humble origin, but talented, Chandragupta defeated Alexander's general Seleucus Nikator around 306 BC and spread his empire from the north west frontier to Magadha and up to the present day Karnataka border. Not only this,

⁵⁰ Mookerji, Radhakumud, *Chandragupta Maurya and His Times*, Motilal Banarsidass, New Delhi, 1988, p.16.

it is said (as per a legend by Thomas R. Trautmann) that Chanakya added little amount of poison secretly to Chandragupta food daily to make him immune of poison and hence ensure his safety. The food was once shared with Chandraguptas' wife (pregnant) and now Chanakya had to reveal his secret. Chanakya had to cut open the stomach and kill Bindusaras' mother (Chandraguptas' wife) to save the life of Chandragupta's son, but till then a drop of poison had reached the forehead of the infant (hence he was called Bindusara) and this incident was used by Chanakya's enemies to brainwash the mind of Bindusara against Chanakya. So, deeply hurt Chanakya, decided to commit self immolation, which he did. Chandragupta ended his life by starving to death (Santhara) in Jain manner and did it in Chanadragiri hills in present day Karnataka, after renouncing the throne for his son Bindusara. Chandragupta Maurya also maintained good foreign relations with Greece, Egypt etc. and the same policy was continued till the rule of Asoka the great.

Other Alumni

4) **Vishnu Sharma:-** He was the author of the book on ethics and code of conduct, Panchtantra and a professor of ethics at Taxila.⁵¹

5) **Prasenjit:-** King Prasenjit of Kosala was taught at Taxila.⁵² He was a disciple of Lord Buddha.

6) **Jyotipala :-** The commander in chief of Prasenjit was Jyotipala, who was a famous alumni of Taxila.⁵³

⁵¹ Khan, Zeeshan, *Right to Passage : Travels through India , Pakistan and Iran*, SAGE YODA PRESS, New Delhi , 2016, p.118.

⁵² Sagar, K.C., *Foreign Influence on Ancient India*, Northern Book Centre, New Delhi, 1992, p.297.

⁵³ Dani, Ahmad Hassan, *History of Pakistan: Pakistan through the Ages*, Sang-e-Meel Publications, Lahore, 2007, p. 87.

Contribution to Sanskrit Literature

The learning centre at Taxila made several contributions to the growth and development of Sanskrit literature. Besides promoting the study of Vedic literature it helped in its proper propagation also. It is a notable point that the Vedic literature developed (especially the Rig Veda and the Sama – Veda) in the Sapt –Sindhu region and since Taxila was the most important centre of education, the origin and development of Vedic literature must have surely been witnessed by Taxila. The contributions of Taxila is limited regionally. It is also said that Vishnu Sharma, also migrated from Asmaka Janapada to Taxila and later on, became a well versed author.

Importance As A Religious Centre

Important point is that, Taxila is said to be the place where the legendary king Janmajeya had performed the serpent sacrifice and the serpent was the Cobra (cobra snake) which was named ‘ Takshak Naag’ and hence the name Takshasila/Taxila. We need to take cognizance of the fact that, Snake in Indian tradition denotes time, and time has been portrayed in a cyclic manner in Indian culture.⁵⁴

CONCLUSION

Taxila had its own way of imparting education and had unique characteristics which were inherited by other institutions that were a part of Ancient Indian Education. Throughout its journey of about 1500 years, it had different experiences- sweet and sour.

⁵⁴ Thapar, Romila, *The Penguin history of Early India from the origins to AD 1300*, Penguin, London, 2002, p.2

It experienced several types of changes- cultural, social, economic, and most importantly, in academics. Besides producing eminent personalities in several fields, it gave the message of universal brotherhood.

Taxila was also known for the study of subjects like law (Dharmasastra). This must have produced men of ethics and high morality. The financial management of the educational system also gives the present educational system, a lesson. We must pay adequate attention to the advantages and the positive aspects of the Taxila school.

Chapter III

ARCHAEOLOGICAL REMAINS AND THE GLORIOUS PAST

During the time of Lord Buddha, Taxila was a great centre of study, research and innovation. The author, Zeeshan Khan has called Taxila as the Oxford of Ancient times.¹ Pasendi (Prasenjit) of Kosala, Bandhula of the Mallas, and Mahali of the Lichchhavis were classmates. Taxila was connected with Pushkalavati (where a museum is situated) in the Northwest and Magadha and Kashi in the East.² The name *Gandhara* appeared first in Rigveda in a poem on Gandhara attributed to an ancient Aryan ruler Ganarae who first established a colony in the area.³

Taxila was an extensive site and it was spread through several areas adjoining it and its, details have been categorized for the sake of convenience. Bhirmound was the original and the oldest area of Taxila. It flourished from 6th to 5th centuries BC onwards. It was a small centre and haphazardly planned. But it was the meeting place of several civilizations. Its streets and lanes were perpendicular – the streets following north-south and lanes east-west directions. The main street called ‘Number One’ by Sir John Marshall⁴ was parallel to an average width of twenty-two feet. Sirkap, the second phase of the city of Taxila

¹ Khan, Zeeshan, *Right to Passage : Travels through India, Pakistan and Iran*, SAGE YODA PRESS, 2016, p. 118.

² Dil, Anwar, *Intercultural Pakistan : Taxila and Hindko Region*, Intercultural forum, San Diego, Islamabad and Gandhara Hindko Academy, Peshawar, 2015, p.71.

³ *Ibid.*

⁴ *Ibid.*, p.73.

was founded by the Bactrian Greeks who moved their capital from Bhir Mound to the northeast side, without decreasing the importance of Taxila, under the domination of Greek, Saka, Parthian, and Kushan rulers. It provided more open spaces and the neighbouring sources of fresh water. New Architecture of buildings were constructed in line with the Hellenistic town plans.⁵

One of the most beautiful buildings was the Shrine of Double Headed Eagle. This motif must have been introduced by the Scythians. In the southern part of Sirkap on the slopes of Hathial with a spectacular view of the whole area below was the Kunala Stupa on a rectangular base built by Asoka for his son.⁶ Asoka also built a number of other stupas containing the Buddha relics.⁷ The biggest one, approximate

⁵ *Ibid.*

⁶ *Ibid.*

⁷ *Ibid.*



Figure 7: The Double Headed Eagle Stupa

(Source:

<https://en.wikipedia.org/wiki/Sirkap#/media/File:SirkapDoubleHeadedEagleStupa.JPG>)

, accessed 12th July 2018.

circular on a raised terrace with four flights of steps, was called the Dharmarajika because Buddha was believed to be the Dharmaraja.⁸

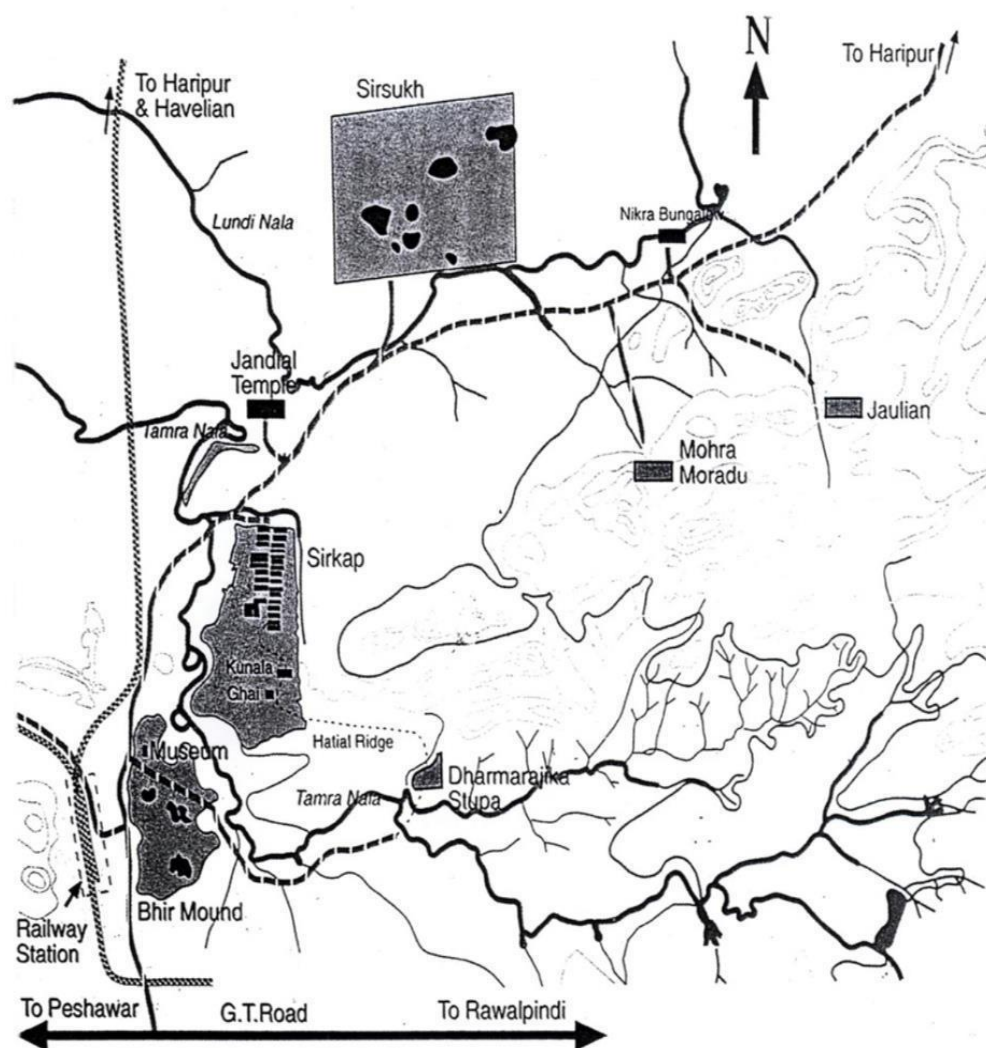


Figure 8: Map showing main sites in Taxila area.

(Source: <http://whc.unesco.org/archive/periodicreporting/apa/cycle01/section2/139-summary.pdf>)

⁸ *Ibid.*, p.74.

Pakistani scholars claim that the Dharmarajika stupa was built by Kanishka, but this claim in itself is doubtful because Asoka is considered as the main propagator of Buddhism in Taxila.⁹

Sirsukh represented the third and the last face of Taxila and is notable for its stone masonry, rectangular planning, and the defensive wall.¹⁰ Sirsukh was more a suburban settlement with a large rectangular fort. According to Ahmad Hasan Dani, a number of items of pottery were discovered because of the excavations.¹¹



Figure 9 : Jaulian Stupa

(Source: http://www.geocities.jp/silkroad_1044/Pakistan/07_e.html)

⁹ Dil, Anwar, *Intercultural Pakistan : Taxila and Hindko Region*, Intercultural forum, San Diego, Islamabad and Gandhara Hindko Academy, Peshawar, 2015, p.74.

¹⁰ Ibid.

¹¹ Ibid.



Figure 10 : The UNESCO board at the entrance gate
(Source: http://www.geocities.jp/silkroad_1044/Pakistan/07_e.html)



Figure 11: The monastery site at Piplan
(Source: <https://www.dawn.com/news/1384311>)



Figure 12: UNESCO has declared Taxila as a world heritage site

(Source:https://www.google.com/search?q=taxila+unesco+world+heritage+site&source=lnms&tbm=isch&sa=X&ved=0ahUKEwj-ol6z3PvdAhVJP48KHVI2DB4Q_AUIDygC&biw=1366&bih=654#imgsrc=U0IBOc1xyE1WRM:)

WHY TAXILA IS IN DARK ?

The site of Taxila, inspite of gaining recognition as the world heritage site, has been irreparably damaged. It has remained in dark and the common man is still unaware of several aspects of Taxila. The reasons for this oblivious state of Taxila are summarized below:

1. **The long ignorance-** Taxila had been forgotten for 1000 years and no archaeological excavation took place for a long time.¹² It was discovered the early in decades of 20th century and went to Pakistan after partition and was further ignored.

¹² <https://www.ancient.eu/taxila/>, accessed on 29th June 2018.

Geological cause - Being an earthquake prone zone, the ancient artefacts must have been destroyed in huge numbers and a huge loss

was caused to the cultural heritage of the world as a whole.

There was a major earthquake in 40 AD.

2. Negligence of the Pakistan government- The government of Pakistan has neglected Taxila. Below mentioned report of The

***Dawn** newspaper proves it:

“ NOT many in Pakistan appreciate history, and this attitude has resulted in the neglect of our historical heritage. As reported in this paper, the Taxila Museum’s Archaeological Conservation and Research Laboratory is in bad shape. Set up at a cost of Rs30m, the lab was shut down after the ministry of culture was devolved two years ago. Presently, both the museum and the lab are under the Punjab government’s control. Even while the lab was functioning it suffered chronic staff and expertise shortages. In a rather bizarre example of ad hoc measures, for example, apparently cleaning staff were deputed to look after the museum’s relics in the absence of technically trained staff. The central issue behind such a state of affairs is a neglect of and apathy towards history. There is a general lack of interest in — and perhaps even disdain for — the past. Perhaps that is why no one bats an eyelid when flood victims set up camp on historic burial grounds, or when world heritage sites and ancient artefacts are treated carelessly. In Taxila’s case, beyond neglect of the lab and museum, encroachments and industrial activity around the area are also threatening this essential link to Pakistan’s past.”

*** The Dawn, Pakistani English newspaper – 7th June 2013** (<https://www.dawn.com/news/1016575>)

Another clipping from the same newspaper is -

Dharmarajika Stupa — left to decay

[Shiraz Hassan](https://www.dawn.com/news/1147872) November 30, 2014 (<https://www.dawn.com/news/1147872>)



Figure 13

The main structure of Dharmarajika Stupa. It is believed to have been built around holy relics of the Buddha in 3rd century BC.

“The historic Dharmarajika Stupa is located just 3km from Taxila Museum. It is not merely a stupa but a complex, having a central stupa, with several small stupas, temples and other ancient remains. Dharmarajika, commonly known as ‘Chir Tope’, is considered one of the eight largest Buddhist stupas in South Asia built around the holy relics of the Buddha by Maurya Emperor Ashoka in 3rd century BC. It is located on the bank of Dharma rivulet.

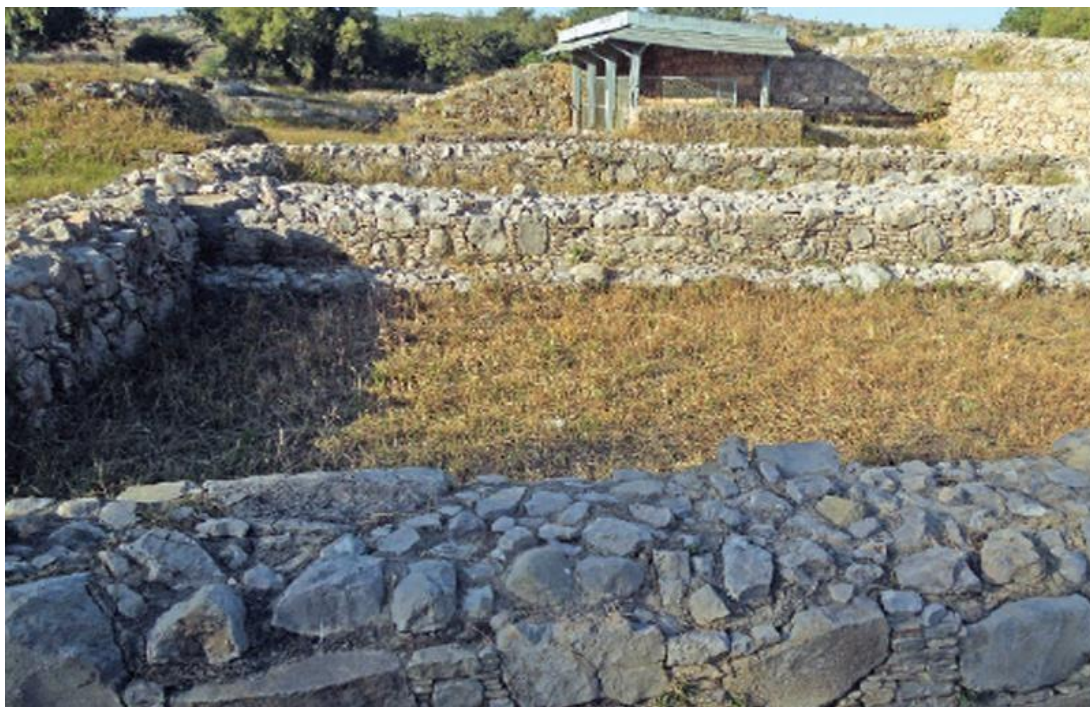


Figure 14

Remains of the 1st century AD double-chambered chapel standing on a high plinth, access to which was provided by a flight of steps on the northern side.



Figure 15

There are several Buddhist temples located in the complex. It is claimed that different structures were constructed around the stupa during different periods. The stupa was badly damaged during the earthquake in 40 AD. However it was rebuilt twice by the Kushana rulers. Today, the Dharmarajika Complex is in ruins. Most of the artwork and engraved statues are badly damaged and in need of preservation work. Other parts of the complex seem to have been totally ignored and abandoned.”



Figure 16

Disfigured statues of Buddha on the outer wall of a medium-size stupa. ¹³



Figure 17

¹³ <https://www.dawn.com/news/1147872>, accessed on 29th June 2018.

IMPORTANCE

We can estimate the importance of Taxila by understanding the example it had put forward before the complete academic intelligentsia, in various fields. The son of emperor Asoka, Kunala got his eye operated at Taxila.¹⁴

Srikanta Sastry has commented that:

“Takshasila was thus the oldest University centre and even Banaras seems to have acquired its importance when the graduates of Taxila settled in that city as teachers. Due to the invasions of foreigners – Yavanas, Hunas, Shakas, Parthians and others, Taxila seems to have declined in the early centuries of the - Christian era. The torch of learning was handed on however to the universities of Valabhi in Gujarat, Banaras and Ujjaini in Central India, Pataliputra, Nalanda and Vikramasila in Eastern India, Kanchi Bahur, Belagami in South India, until the Mathas or monasteries established by Sankara and other religious leaders took up the responsibility for higher education.

Takshasila's contribution to Indian art is by no means negligible. The influence of the Gandhara school of sculpture, with Hellenistic motives and inspired by Mahayana Buddhism can be seen in the later Gupta art. The Indian craftsmen absorbed foreign techniques but transformed it so that except in certain external features it is thoroughly Indian. The gold and silver jewellery found at Taxila shows the skill of the Indian craftsmen. Some Greek and Roman as well as Mithraic motives were reproduced. But generally the ornaments, gold and silver vessels, were manufactured by native craftsmen and exported to Greece and Rome as the recently discovered image of Lakshmi or Yakshini at Pompeii testifies. The Indian ivory

¹⁴ Lillie, Arthur, *The popular life of Buddha*, London, Kegan Paul, Trench and Co., Paternoster Square, 1883, pp. 302-304.

carvers - Dantakaras were famous throughout the ancient world.

*“One ignorant of
the land asks of
one who knows it;
He travels forward
instructed by the
knowing guide,
this, indeed is the
blessing of
instruction;
One finds the path that leads straight onward”-
Rig Veda.¹⁵*
”



Figure 18: Statue of Buddha at Taxila- Note the Greek influence. ¹⁶

¹⁵ http://www.srikanta-sastri.org/download/i/mark_dl/u/4008488728/4613425114/Taxila%20-%20An%20Ancient%20Indian%20University%20by%20Dr%20S.%20Srikanta%20Sastri.pdf, accessed on 29th June 2018.

¹⁶ <https://en.wikivoyage.org/wiki/Taxila> , accessed on 12th July 2018.

CONSERVATION AND PROTECTION

Conservation and protection of a world heritage site, that too in a country with overall socio-economic and political instability has been a challenging task. Although, the Pakistani government has taken some steps, but much more needs to be done to improve the dilapidated condition of Taxila, but much more needs to be done as the danger of cultural genocide in Pakistan has eclipsed the site.

Below mentioned points need consideration -

1. The monument has been protected under Antiquities Act, 1975.¹⁷
2. The repair and maintenance of the important sites has been neglected¹⁸ (as per state of conservation report).
3. Although the area has been protected, it has been yielding precious artefacts to the local people surprisingly,¹⁹ like Farmers and other people who dig the ground – these artefacts are neglected by the government . So, there is an urgent need to cherish and conserve the world heritage site. It has to be done by both conventional and modern methods.

Below are some suggestions to conserve the monuments here:

1. Spreading awareness about the importance of the world heritage site among the common people of Taxila and Pakistan as a whole – museum officials of the Taxila museum can play a very important role and have been doing so.

¹⁷ <https://whc.unesco.org/en/list/139>, accessed on 29th June 2018.

¹⁸ http://www.globalheritagefund.org/images/uploads/docs/GHFAsiaHeritageinPeril050112_lowres.pdf, accessed on 29th June 2018.

¹⁹ <https://www.cbsnews.com/news/pakistan-struggles-to-control-smuggling-of-buddhist-antiquities-for-black-market-trade/>, accessed on 29 June 2018.

2. Encouraging foreign tourism and foreign funding for protection and conservation will definitely help. For example –apart from UNESCO, bodies like SAARC (South Asian Association for Regional Cooperation) can help to preserve the joint cultural tradition of the Indian Subcontinent and South Asia in general.

CONSEQUENCES OF PRESERVATION

1. The glorious past of Taxila may inspire the people of Pakistan to uplift their degraded educational standards and produce global citizens, which are needed for the 21st century.
2. It will play a pivotal role in improving Indo Pak relations, that too culturally, socially and economically.
3. It can help researchers to better understand the problem of climate change environmental degradation in Ancient China and Ancient India.
4. It may revolutionize the Mathematical world by the analysis of the concept of zero in the Bakhshali inscription.

The Bakhshali inscription is given below as per Oxford University Researchers-

20“Carbon dating reveals Bakhshali manuscript is centuries older than scholars believed and is formed of multiple leaves nearly 500 years different in age

By David Howell, Head of Heritage Science at

20https://www.google.com/url?sa=t&source=web&rct=j&url=https://www.science-mag.org/sites/default/files/Bakhshali%2520Research%2520Statement_13%25209%252017_FINAL.pdf&ved=0ahUKEwjOtLi4x-3bAhVCuY8KHS8TCMkQFggqMAE&usg=AOvVaw37u5NAhKL98cnYWEUscKxT, accessed on 27th June 2018.

the Bodleian Libraries 3 July 2017

Introduction:

The Bakhshali manuscript, an early Indian mathematical treatise housed at the University of Oxford's Bodleian Libraries, has for the first time been radiocarbon dated. The results reveal that this very rare birch bark manuscript dates from more than four centuries earlier than scholars previously believed. Previous dating of this ancient mathematical record had been estimated based on the style of writing and the literary and mathematical content.

The dating of the manuscript has long been the subject of academic debate but there has never before been any consensus on its exact age. Scholarly estimates ranged dramatically from 200 CE to 1100 CE. Now, new carbon dating results produced by a team of researchers at the University of Oxford are able to shed light on why it has previously been so difficult for scholars to pinpoint the manuscript's date. It is actually composed of material from at least three dates, with some pages dating from as early as the 3rd to 4th century and others dating from the 8th and 10th centuries.

The date of the manuscript was particularly important to determine because of the Bakhshali manuscript's significance in the early history of mathematics. The manuscript contains one of the earliest uses of zero (written as a dot in this manuscript) as a placeholder, i.e. the use of zero to indicate orders of magnitude in a number system.

Background on the manuscript:

The Bakhshali manuscript, which consists of 70 leaves of birch bark, is a manuscript of Indian mathematics that was discovered in 1881 in a region of what is now Pakistan, not far from the site of the ancient trading centre of Taxila.

The most authoritative treatise on it is the Brown University Ph.D. thesis of Takao

Hayashi, now on the faculty of Doshisha University in Japan. The text's structure consists of rules and sample problems in verse, with a commentary explaining them. It is not clear whether the rules and sample problems and the commentary are the work of a single author or not. Hayashi dated the content of the manuscript to the 7th century due to the similarities of its style and vocabulary with that of other medieval mathematical works (Hayashi 1995, 148–9). It is likely that the text was then copied in manuscripts and Hayashi asserted that the oldest extant copy of the text, housed at the Bodleian Libraries, dated from a period ranging from the 8th to the 12th century (Hayashi 1995, 23–25).

In early 2017, a team of researchers from the University of Oxford's Bodleian Libraries and the Oxford Radiocarbon Accelerator Unit collaborated on a project to carbon date this remarkable manuscript. After lengthy discussions, and based on stylistic grounds, the team decided that it was not possible to take just one representative sample. Five samples were extracted from the manuscript, three of which were used for the C-14 analysis, with the remaining two samples being kept intact. This process, including the location where the samples were extracted from, is fully documented for future reference. The results reveal that the three samples tested date from three different centuries, one (Folio 16) from 224-383 AD, another (Folio 17) from 680-779 AD and another (Folio 33) from 885-993 AD.

Background on radiocarbon dating:

Radiocarbon dating is one of the most widely used scientific dating methods in archaeology and environmental science and can be applied using most organic material formed during the last 50,000 years. Radiocarbon is a naturally occurring radioactive isotope of the element carbon and is continually produced in the upper atmosphere due to cosmic rays striking the earth. It is quickly mixed into carbon

dioxide and distributed throughout the atmosphere and oceans. Plants and trees then incorporate the carbon dioxide via photosynthesis and use the carbon to build structures, such as those that form the birch bark on which the Bakhshali manuscript was written. As soon as this carbon is locked into the structure of the bark, it is isolated from the atmosphere and no new radiocarbon can be added. Radiocarbon decays with a half-life of 5,730 years, so once the bark is formed the amount of radiocarbon within it decreases but the amount of stable carbon in the bark remains constant. By measuring the ratio of radiocarbon to stable carbon in the bark it is possible to calculate how long ago the bark was formed.

Of course, there are some complications involved in radiocarbon dating, two of which are variations in the atmospheric concentration of radiocarbon and the possible contamination of the material to be dated.

Variations in the atmospheric concentration of radiocarbon can be caused, among other sources, by a change in the production rate of radiocarbon in the upper atmosphere or changes in ocean circulation. These atmospheric variations can affect the radiocarbon age of a material, for example if organic material was formed during a period of low atmospheric radiocarbon concentration it may appear no younger than older material formed during a period of high atmospheric concentration. To deal with this complication, radiocarbon measurements are calibrated against material of known age (such as tree rings dated by dendrochronology) to give calibrated age ranges, which are usually presented as 95% confidence intervals.

The easiest way to deal with potential contamination is through careful sampling. For this reason areas of ink in the Bakhshali manuscript were avoided when taking samples, because the ink will likely contain carbon of a different age to

the bark (and the age of the carbon in the ink would very likely not correspond with the date that the manuscript was written). Beyond this, material to be radiocarbon dated routinely undergoes chemical pretreatment to remove as much potential contamination as possible without destroying the sample. The Bakhshali samples were very small (1.4 to 1.8 mg of bark) so were treated with a mild chemical pretreatment, which included washes using organic solvents to remove any oils or grease on the manuscript and a sequential acid-base-acid wash to remove any potential carbonates or humics.

Methodology:

Three samples of bark (*Betula sp.*) from three different folios of the Bakhshali manuscript were used (Folio 16, 1.83 mg; Folio 17, 1.51 mg; Folio 33, 1.39 mg). The bark was pretreated with sequential washes of organic solvents (acetone, 50°C, 1 hour; methanol, 50°C, 1 hour; chloroform, room temperature, 1 hour) and three rinses of ethanol and four of ultrapure water, before sequential washes of 1 M hydrochloric acid, 0.2 M sodium hydroxide and 1 M hydrochloric acid. After each acid and base wash the samples were rinsed three times with ultrapure water. (ORAU pre treatment code VV*; Brock et al., 2010).

After chemical pretreatment the bark samples were converted to carbon dioxide using an elemental analyzer, the carbon dioxide was graphitized at 560°C in the presence of hydrogen gas and an iron catalyst (Dee and Bronk Ramsey, 2000) and the radiocarbon content of the graphite determined using the Oxford accelerator mass spectrometer (Bronk Ramsey et al., 2004). Radiocarbon measurements were calibrated against the IntCal 13 curve (Reimer, 2013) using OxCal v4.3.2 (Bronk Ramsey, 2009).

Results:

Radiocarbon determinations and calibrated age ranges are shown in Table 1.

Table 1: Laboratory codes, radiocarbon determinations, stable carbon isotope composition and calibrated ages for the birch bark from the Bakhshali manuscript. Presented uncertainties in the radiocarbon determination are one standard deviation.

Sample	ORAU laboratory code	Radiocarbon determination / BP	$\delta_{13}\text{C}$ / ‰	Calibrated age, 95.4% confidence interval / cal AD
Bakhshali folio 16	OxA-35,405	1751 ± 29	-27.3	224 – 383
Bakhshali folio 17	OxA-35,406	1247 ± 27	-27.0	680 – 868
Bakhshali folio 33	OxA-35,407	1108 ± 26	-24.6	885 – 993

Discussion:

Significance of the results for the history of mathematics and the birth of zero.

Oxford University Professor of Mathematics Marcus du Sautoy:²¹

The Bakhshali manuscript is significant for the history of mathematics because it contains numerous dots representing nothing or zero. Until now, it was never known how old this zero was.

The zero used in the Bakhshali manuscript is not yet a number in its own right. It is a place holder being used as part of another number written in the place number system. We write 101 to indicate 1 hundred, no tens and 1 unit. The zero is indicating the absence of 10s. This idea of needing a symbol to represent nothing as part of writing numbers in the place number system has a very ancient heritage. 5000 years ago, the Babylonians used a double wedge for nothing as part of the cuneiform symbols to write numbers on stone tablets. The Mayans were using a symbol of a shell to denote absence in their number system 2000 years ago.

So the dot used in the Bakhshali manuscript cannot claim to be the first use of zero as part of building larger numbers (as a placeholder). But why it is so exciting is that this zero used in India, represented by a dot, is the seed from which the concept of zero as a number in its own right emerged some centuries later, something many regard as one of the of the great moments in the history of mathematics. In other words, it was the dot that we see in the Bakhshali manuscript that went onto become the symbol that was first used for zero as a

²¹https://www.google.com/url?sa=t&source=web&rct=j&url=https://www.sciencemag.org/sites/default/files/Bakhshali%2520Research%2520Statement_13%25209%252017_FINAL.pdf&ved=0ahUKewiOtl4x-3bAhVCuY8KHS8TCMkQFggqMAE&usg=AOvVaw37u5NAhKL98cnYWEUsckxT, accessed on 27th June 2018.

number in its own right.

The idea of creating a symbol to represent nothing is one of the great mathematical breakthroughs in the history of mathematics. The creation of zero as a number in its own right, not as a mere placeholder, represented by a circle or a dot happened in India where contemplating the void was part of the philosophy of that region. The idea of zero as a number first appeared in the astronomer Brahmagupta's text, *Brahmasphutasiddhanta*, which was written in 628 CE and is the first text to talk about zero as a number in its own right and to include a discussion of the arithmetic of zero.

The Bakhshali manuscript helps to illustrate how vibrant mathematics has been in India and the east for centuries. It is also testament to the way mathematics crosses cultural, historical and political boundaries. The concept of zero is used across the globe. It is a key ingredient of the digital world. Yet we now know that it was mathematicians in India in 200-400 CE who planted the seed of the idea that would become so fundamental to the modern world.

Significance of the results for South Asian cultural history:

Camillo Formigatti, John Clay Sanskrit Librarian at the Bodleian Libraries:

The carbon dating has revealed that the Bakhshali manuscript is a composite document and consists of at least three different parts with different ages. Due to the fragmentary nature of the manuscript, it is difficult to reconstruct the original order of the folios and consequently of the extant texts. Until now, the

manuscript has been studied as if it were one single item. The first editor of the manuscript, G. R. Kaye, employed the following criteria to establish the order of the folios:

- (1) Logical sequence of contents.
- (2) The ‘find order.’
- (3) Physical appearance such as the size, shape, degree of damage, and knots in the birch bark.
- (4) The script and language.
- (5) Numbered sūtras.

In the most recent complete study of the manuscript (1995), Takao Hayashi does not deem the fourth criterion reliable enough for the reconstruction of the order of the folios. This approach is again based on the assumption that all extant parts of the manuscript were written at the same time – an assertion now overturned by the new carbon dating results.

The early date of folio 16 fits well into the cultural milieu in which this part of the manuscript was probably produced and circulated.

The content of the Bakhshali manuscript is similar to the type of texts that Buddhist merchants would have needed to study (and possibly use as reference) for their daily trading activities. It includes very practical mathematical examples and equations, such as how to compute the loss in weight of a quantity of impure metal in the process of refining it, etc.

The manuscript was recovered in the village of Bakhshali in Pakistan, in an area that belongs to the historical Gandhāra region. It is a region in which major cities such as Peshawar (Skt. *Puruṣapura*) and Taxila (Skt. *Takṣaśilā*) were important commercial and cultural hubs. This area belonged to the Indian,

Persian, and Greek cultural spheres of influence and had contacts with Chinese culture through the Silk Road. The oldest Buddhist and South Asian manuscripts extant were also found in the Greater Gandhāra region and their dates range from the first century BCE to the fourth century CE – so a similar time period to that of folio 16 of the Bakhshali manuscript. Although written in a different script and a different language than the Bakhshali manuscript, these Buddhist manuscripts are also written on birch-bark.

Moreover, the language used in the manuscript is not standard Sanskrit, and according to Hayashi it shows features of what is called Buddhist Hybrid Sanskrit, as well as of other Middle-Indo Aryan languages (Prakrit and Apabhraṃśa), and also of Old Kashmiri. This is yet another feature that can be explained by the fact that the manuscript in its present state is composed of at least three different manuscripts with different dates. The three dates would then correspond to different stages of linguistic development. This assumption however has to be corroborated by a closer linguistic study of the manuscript. The carbon dating results are likely to help scholars to better reconstruct the original structure of the different manuscripts and the order of the folios, and hopefully to be able to make a more informed assessment of the different textual layers.” Additional note:

“The Bakhshali manuscript is the sole surviving copy of a mathematical text or texts. Carbon dating has revealed it to be at least three manuscripts gathered together into one manuscript. It is possible that the Bakhshali manuscript is

up of more than one text. More research is needed to better understand what the manuscript consists of.”²²

NEW EFFORTS BY UNESCO

UNESCO with the help of digital technology has decided to preserve the Taxila artefacts.²³ Accurate three-dimensional structures of the Taxila city and the web site visit of Taxila Museum will be possible.

Close range scanning will be available for stupas using satellite imagery. A website of Taxila Museum would be constructed and two dimensional imagery of the artefacts would be available to view. Architecture, old artefacts and city planning will be available to see from the website. It will attract Global attention from historians, artists, architects, painters and town planners. Moreover, it will a knowledge repository available from any corner of the world about one of the most important Buddhist sites in the Indian subcontinent .

The archaeological importance of Taxila as a Neolithic site may also be probed deeply and it may be helpful in other disciplines of social sciences like cultural, demographic and ethnographic studies.

²² https://www.google.com/url?sa=t&source=web&rct=j&url=https://www.sciencemag.org/sites/default/files/Bakhshali%2520Research%2520Statement_13%25209%252017_FINAL.pdf&ved=0ahUKewjOtLi4x-3bAhVCuY8KHS8TCMkQFggqMAE&usg=AOvVaw37u5NAhKL98cnYWEUsckxT, accessed on 27th June 2018.

²³ <http://repository.iucaa.in:8080/jspui/bitstream/11007/2340/1/982E%20Taxila.pdf>, accessed on 29th June 2018.

CHAPTER IV

CONCLUSION

The learning centre of Taxila, if analysed carefully can teach us several things, which can solve our contemporary problems of the present day Indian society and the world as a whole. Some of the important lessons which we get from Taxila are:

1. **Environmental Harmony** – Since the hymns of the Rig Veda are filled with the message of environmental conservation, Taxila made a great contribution to environmental conservation as the Rig Veda was taught there (already mentioned in the previous chapters).
Many of the Rig Vedic hymns describe the Dyava/Prithvi, that is, they describe the heaven and the earth together. Mention of Vedic Gods like Mitra, Varuna, Indra and Maruts is common.¹ It is a point to be noted that the present day Naval exercises of the Indian navy are named after the Vedic God Varuna.²
2. **Cultural Conglomeration** – Since students from different lands and different cultures studied at Taxila, there must have been a sense of unity in diversity. The finest example is the Gandhara school of art, which demonstrates the Greek influence over Buddhist statues very well.

Apart from the Buddhist faith, there is sufficient evidence to prove that Jainism, Zoroastrianism and early Hinduism were also present.³

The eagle headed stupa has Greek, Persian and Indian influence too. The Zoroastrian influence in the Jandial temple is well evident.⁴

¹ <https://timesofindia.indiatimes.com/Vedic-perspective-on-environment/articleshow/4613346.cms> ,accessed on 12th July 2018

² [https://en.m.wikipedia.org/wiki/Varuna_\(naval_exercise\)](https://en.m.wikipedia.org/wiki/Varuna_(naval_exercise)), accessed on 12th July 2018

³ www.ancient.eu/amp/1-13819/, accessed on 12th July 2018

⁴ www.ancient.eu/amp/1-13819/, accessed on 12th July 2018.

3. **Research and Innovation encouraged** - The university in an ideal sense should comprise of – academic teaching, research in a scientific and scholarly manner and also a creative cultural life.

Taxila was vibrant in all the above mentioned ways and different branches of knowledge were co-related like the *Arthashastra*⁵ co-relates economics and political science. The *Panchtantra*⁶ co-relates ethics and the practical part of leading life. Alexander himself took with him several scholars from Taxila, while returning back.

GHANDHARA ART

❖ GANDHARA ART, NAMED AFTER THE REGION OF GANDHARA NOW IN PAKISTAN, PRESENTS SOME OF THE EARLIEST IMAGES OF THE BUDDHA.

❖ THE GANDHARA STYLE WAS PROFOUNDLY INFLUENCED BY 2D-CENTURY HELLENISTIC ART AND WAS ITSELF HIGHLY INFLUENTIAL IN CENTRAL AND EASTERN ASIA.

❖ GANDHARA SCHOOL WAS BASED ON GRECO-ROMAN NORMS ENCAPSULATING FOREIGN TECHNIQUES AND AN ALIEN SPIRIT. IT IS ALSO KNOWN AS **GRAECO-BUDDHIST SCHOOL OF ART**.



Buddha Head as depicted in Gandhara Art



Courtesy:

<https://www.google.com/search?q=gandhara+school+of+art&source=lnms&tbm=isch&s>

⁵ www.ancient.eu/amp/1-12635/ , accessed on 12th July 2018.

⁶ Duggan, Anne E and Haase, Donald and Callow, Helen J, *Folktales and Fairy tales : traditions and texts from around the world, revised and expanded (ed.)* Second Edition Volume 3: P-Z , Greenwood, p.757, 2016.

a=X&ved=0ahUKEwiUgZTRI5vcAhUHTI8KHYJpB-
cQ_AUICigB&biw=1366&bih=659#imgsrc=eQoRuDthlvzELM:

The rise of political anarchy must have affected the academic atmosphere to a considerable extent and several cultural streams must have amalgamated –the Indo-Greeks, Bactrians and the Kushanas.

4. **Practical Part of Education stressed upon** - It has been mentioned that different students took different time period in completing their course.⁷ It indicates that individual attention was paid to every student.

The famous story that Jivaka the physician was able to demarcate the medical properties of each and every herb proves the practicality of education which was imparted.

5. **Scientific Innovation encouraged** - Scientific techniques like the distillation process,⁸ glass making etc . were well known.⁹ Traces of other metals like lead, antimony, tin and manganese have been found in the glass at Taxila, when it was examined.
6. **Society Funded the Education** - Society provided all the necessary financial assistance and boarding and lodging was provided free of cost. No student was required to pay any fees on compulsory basis. Knowledge was considered too sacred to be bartered for money. Some of the well to do parents gave generous financial help. The royal people also donated money generously, without exercising any control over the teachers. Even the poor students who could not pay for the expenses of their education could attend night classes.
7. **No age bar for learning** – Even married students learnt at Taxila and there is a story that a married man, studying at Taxila in the night was disturbed by his wife. The Jatakas are full of such references.

Today, education is linked to the livelihood of the people . The great educationist and Noble prize winner Rabindranath Tagore had said:

“ The highest education is that which does not merely give us information but makes our life in harmony with existence.”¹⁰

⁷ Apte, D.G., *Universities in Ancient India*, p.9.

⁸Needham, Joseph, *Science and Civilisation in China Volume 5 : Chemistry and Chemical Technology*, Cambridge University Press, 2009, pp. 85-87.

⁹Bharadwaj, H.C., *Aspects of Ancient Indian Technology*, Motilal Banarasidas, 1979, pp. 66-67.

¹⁰ Hogan, Colm Patrick and Pandit ,Lalita, *Rabindranath Tagore: Universality and Tradition* , Fairleigh Dickenson and London : Associated University Presses, 2003, p.76.

In Ancient India, this was followed in word and spirit, with the Gurukul system. It made us harmonious with nature and all its creation.

In the recent scenario, when an organization¹¹ World Intellectual Property Organization (WIPO), and Cornell University, USA rank India in the rank range of 60-66, it should be a matter of concern for us that we slipped down, from being the topmost intellectual capital of the world to an average ranking.

The Union Finance Ministry,¹² in its economic survey says that India spends only about 0.6-0.7% of its GDP in research oriented activities. The developed countries spend much more.

Many a times, situation compels us to turn to the past to solve present day problems. A fine example is illustrated below, as per the report 'Management of Chikungunya through Ayurveda and Siddha' of the Government of India:

'Every year in the National Capital Delhi and in the whole country, the dreadful disease Chikungunya, kills thousands of people during the rainy season. There is no proper Vaccine or Medicine for Chikungunya in allopathic system of medicine. **The health ministry, called the ministry of AYUSH has constituted a committee of experts of the Ayurvedic system of medicine (taught at Taxila) and Siddha system of medicine experts to tackle the menace of this dreadful disease.**'

The report says that nearly 65% of the Indian population uses Ayurveda or Ayurvedic techniques. So, the study of an Ancient centre of knowledge is beneficial to us in all respects and promotes the welfare of mankind in all respects.

Scope of Further Research

The partition of India in 1947 after Independence has resulted in the negligence of many aspects of Ancient Indian History and Archaeology. In order to reconstruct the history of Ancient India in a better manner, we must transcend geographical boundaries. Similarly, each centre of education had some unique features. Presently, Jagadala and Sompura Mahaviharas are in Bangladesh.¹³ These were the two famous Buddhist monasteries and centres of education.

¹¹ <https://economictimes.indiatimes.com/news/economy/indicators/india-60th-most-innovative-globally-china-at-22nd-report/articleshow/59160953.cms>, accessed on 12th July 2018.

¹² <https://economictimes.indiatimes.com/news/economy/finance/indias-rd-spend-stagnant-for-20-years-at-0-7-of-gdp/articleshow/62697271.cms>, accessed on 12th July 2018.

¹³

Rashid, MD. M., 'Facts and Narrative - the Concept of 4D Capturing of Heritage Building; a Case Study of Sompur Mahavihara, Bangladesh : Volume XI-5/W2, Issue 1 (22/07/2013)' ;Barua, J.B.,

Ancient Buddhist Universities in Indian Subcontinent, Fulton Books, Meadville, PA, USA, 2016.

The Indian education system, being one of the largest in the world needs to reorient itself, which is now being implemented by various means like SWAYAM portal for professional education etc. India is a country where 65% of the population is below 35 years of age.¹⁴ Also, we are one of the most populous countries of the world.

We need to minimize the drawbacks of technology and optimize the use of technology in a constructive manner to solve the present day problems and maintain harmony with the environment, because in natural Environment one problem is linked to the other problem.

Ancient Gurukuls, or centres of education mostly located in forest areas taught harmony with nature and physical well being to the students. Rabindranath Tagore and his father Debendranath Tagore knew this very well¹⁵ and established the famous university Shantiniketan as a forest university, on the lines of Ancient Gurukul system.

Shantiniketan has been called a university town and Debendranath Tagore has been called as ‘Maharshi ‘, to get a sense of Ancient Gurukul System and the term ‘Ashram complex’ has been used. So, we should take lessons from the Initiatives taken by the best minds in Modern India to improve the quality of education and ultimately catalyse the progress and development of the nation.

We may consider a deep research on the oral tradition of learning (mainly focussed upon in Taxila), which although difficult may result in several new discoveries. The rise of problems like climate change and global terrorism, which now threaten the whole world could be solved by making the education system in lines of Ancient Indian Education system, which considered the complete world as a family. The Taxila centre of learning, (although having an informal touch), thus, focussed mainly upon character and personality development apart from academic excellence.

¹⁴ <https://timesofindia.indiatimes.com/city/madurai/By-2020-India-will-have-the-largest-young-workforce/articleshow/51368384.cms> ,accessed on 12th July 2018

¹⁵ <https://whc.unesco.org/en/tentativelists/5495/> (Rabindranath Tagore said, outlined the nature of Santiniketan, envisioned as the ideal form of the traditional Indian hermitages which had at one time flourished in the forests of ancient India, great seats of learning from which the Upanishads had evolved, exploring a universal and humanistic life of the mind.) ,accessed on 12th July 2018

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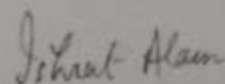
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