



UNVEILING THE SCIENTIFIC METHODOLOGY OF ANCIENT INDIA: A CRITICAL ANALYSIS OF RESEARCH APPROACHES IN INDIAN KNOWLEDGE SYSTEMS

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Abstract

This study explores the rich research methodologies embedded in ancient Indian knowledge systems have a vast treasure of sophisticated research methodologies which is particularly ingrained in Ayurveda and philosophical traditions. By carefully looking at texts like Pramana, *tantrayukti*, and *vada-marga*, we find a detailed way to study things that works alongside modern research methods. Through an examination of classical texts, commentarial traditions, and knowledge transmission techniques from Ayurveda and Darshana, we are able to uncover unique research paradigms that have developed over millions of years. This analysis reveal that these traditional methods offer a more nuanced and context-specific approach to researching Indian knowledge systems, challenging the dominance of Western research paradigms. This research highlights the significance of reclaiming and reinterpreting ancient Indian research methodologies, providing a robust foundation for evidence-based research in Indian sciences. By bridging the gap between traditional and modern research approaches.

Keywords: Research methodology, *āyurveda*, *tantrayukti*, *Vādamārga*, *pancāvayava vākyā*, *kalpanā*, *arthāśrayā*, *tācchillyā*, *pramānās*

Introduction

The Indian knowledge system imbibes a huge repository of scientific wisdom that has made significant contribution to global science. Its potential to address the contemporary scientific challenges remains largely unrealised. Despite this rich heritage, the Indian educational framework continues to incline more to Western research methodologies. This inclination is because of the Indian scholars and administrators ongoing propensity to seek approval of Western community for their contributions of indigenous knowledge.

Indian educational policies have been changed to create opportunities abroad, and Indians are good laborers even after 80 years of independence. If we cross-examine the scientific literature of ancient India, it constantly prioritized beneficial knowledge and healing practices.

Every piece of literature has its textual methodology. When the tendency for research originated in India, they created the six systems of philosophy. Here, the term philosophy is not understood as mere philosophy. *darśanam* is a word that has a large meaning *drśyate anena iti* means through that one sees the reality in this gross world and the supreme *brahman* to be free from the three types of sorrows *ādibhautikam* *ādidaivikam*, and *adhyātmikam*. Means it is a tool for research. Among the six systems, the *Nyaya* system provides a clear scientific methodology to explain the physical world and the supreme reality. It is termed as *pañcāvayava vākyam*. If We study *arthaśāstra* and *Ayurvedic* texts we can find *tantraguṇā*, *tantradoṣā*, and *vādamārgā*. These include *tācchillyā*, *arthāśrayā*, *kalpanā*, *tantrayukti*, and so on. Learning the style of grammar in the Sanskrit language is also very important. If we study all these, we can find out how scientifically the knowledge is examined and systematically presented, and stored. Every system of knowledge followed its own textual methods to arrange the theories they proved with systematic methods. Scholars must use techniques unique to traditional literature and systems to unlock the literature in order to fully access the vast information contained in them. Unfortunately, Western research paradigms are required in modern education, ignoring the classical methods of research



This paper is an eye-opener for educational reforms that reevaluate existing research paradigms and they're by the scholars can rely on the methods of Indian knowledge systems. When used appropriately, these native methods exhibit empirical validity and can resist scientific scrutiny.

It can be convinced and proven if the scholars go deeper into every term used in the textual methods and research tools used in different systems of Indian knowledge, with reference to the context and incorporate them wisely to create a better methodology for the research in the Indian knowledge systems.

Methods and data collection

The required data are collected from different sources, such as *Carakasamhita*, *āstangahridayam*, and *Suśrutasamhita*, and other internet resources, research methodology textbooks, and journals.

The data are discussed critically analyzed and interpreted to establish a research methodology which is more viable for the researches in Indian knowledge system.

vāda mārgas

dravyam guna; karma sāmānyam viśesa: samavāya: pratijñā sthāpanā prasṭhāpanā hetu: drṣṭānta: upanaya: nigamanam uttaram siddhanta: śabda: pratyakṣam anumānam aitihyam aupamyam samśaya: prayojanam savyabhicāram jijñāsā vyavasāya: arthāpatti: sambhava: anuyojyam ananuyojyam anuyoga: pratyayuṣyoga: vākyadoṣa: vākyaprāṣaṇsā chalam ahetu: atītakālam upālambha: parihāra: pratijñāhāni: abhyānūjñā hetvāntaram arthāntaram vīgrahasthānam.

1. **sthāpanā:** *sthāpanā nāma tasyā eva pratijñāyā hetudrṣṭāntopanayanigamanaiḥ sthāpanā|*
Sthāpanā is defined as that which proves the proposition by means of *Hetu* (reason for achievement), *Drstānta* (example), *Upanaya* (application) and *Nigamana* (conclusion)
2. **pratiṣṭhāpanā:** *pratiṣṭhāpanā nāma yā tasyā eva parapratijñāyā viparītārthasthāpanā|*
Pratisthāpanā is the counter argument against the proposal put forward by the opponent.
3. **hetuh:** *heturnāmopalabdhikāraṇam*
The tool which is useful for obtaining the knowledge is known as *Hetu* (reason). It is of 4 Types viz. *Pratyakṣa* (direct observation), *Anumāna* (inference), *Aitihya* (traditional instruction or authoritative statement), *Aupamya* (analogy or similarity). The Knowledge gained from these causes is the truth and thus it is valid.
4. **drṣṭāntaḥ-** *drṣṭānto nāma yatra mūrkhaviduṣām buddhisāmyam, yo varṇyam varṇayati*
Drstānta is the example which gives the knowledge equally to both the scholars and ignorant people. It illustrates the proposition to be established.
5. **siddhāntaḥ-** *siddhānto nāma sa yah parīkṣakairbahuvidhaṁ parīkṣya hetubhiśca sādhayitvā sthāpyate nirṇayāḥ*
The conclusion which has been established by scientists after testing in several ways and on proving it with reasoning is known as *Siddhānta* (Doctrine). It is of 4 Types viz. *Sarvatantra Siddhānta*, *Pratitantra Siddhānta*, *Adhikarana Siddhānta*, *Abhyupagama Siddhānta*
6. **saṁśayaḥ-** *saṁśayo nāma sandehalakṣaṇānusandigdheśvartheśvaniścayah*
In fact *Samśaya* is the uncertainty in cases that are doubtful. For example: Some have signs of long life and some have not; some receive treatment and some do not receive treatment. The first type dies while the latter survives. After watching both, doubts arise whether untimely death is there or not?
7. **prayojanam-** *prayojanam nāma yadarthamārabhyanta ārambhāḥ*
In fact *Prayojana* is that actions or efforts that are done with a definite purpose. For example: If anyone says that a person occurs untimely death, when he resorts to such things and practices to prolong the duration of life and abstains from all such things and practices that are unprovoked, so that untimely death did not come.
8. **vyavasāyah-** *vyavasāyo nāma niścayah*
Vyavasaya means *Niścaya* i.e. determination. For example: This is the disease originated by the vitiation of *Vata* and this is the medicine and certainly useful for its management.



9. **arthaprāptih-** *arthaprāpti* *nāma yatraikenārthenoktenāparasyārthasyānuktasyāpi siddhiḥ*
To obtain the meaning of unmentioned through the mentioned is known as *Arthaprāpti*. The word spoken here is intended to be said for *Śrītārthāpatti* only. And the *Drstārthāpatti* also can be understood in the same way.

10. **sambhavaḥ-** *yo yataḥ sambhavati sa tasya sambhavaḥ*
Sambhava is the source from which something is originated. For example: The six elements are the source for the conception of fetus in the womb. Unwholesome food and activities are the source for the manifestation of diseases and similarly wholesome diet and regimen is the source for health.

11. **anuyojyam-** *anuyojyam nāma yadvākyāṇi vākyadoṣayuktāṇi tat*
Anuyojya is the defectiveness of the statement. Or where general subjects are emphasized, when only special subjects should be adopted, such general claims are *Anuyojya*. For example: The statement like "This disease is quick to respond to purificatory treatment", provokes questions like, 'Is it amenable to emesis or purgation?'

12. **ananuyojyam-** *ananuyojyam nāmātō viparyayena*
Ananuyojya is exactly opposite to *Anuyojya* and here there is no scope for questioning. For example: This disease is incurable.

13. **athānuyogah-** *anuyoga nāma sa yat tadvidyānām tadvidyaireva sārdham tantri tantraikadeśe vā praśnāḥprāśnaikadeśo vā jñānavijñānavacanaprativacanaparikṣārthamādiśyate*
Anuyoga is that which is the query puts to an opponent during the discussion of experts to test knowledge on the whole scripture or to learn, understand, speak and to contradict a particular concept or topic.

14. **pratyānuyogah-** *pratyānuyoga nāmānuyogasyānuyogah*
Pratyānuyoga means *Anuyoga* for *Anuyoga*. That means questioning the question or counter inquiry.

15. **ahetu-** *na satya: hetu:*
The term '*Ahetu*' is that which doesn't prove what it is supposed to be proved or it is a fallacious reason.

16. **hetvāntaram-** *hetvāntaram nāma vikṛtahetuvacya:*
Hetvāntara means where a person cites a different or incorrect reason rather than stating a proper reason.

tantrayuktaya

1. **adhikaranam:** *yadadhiκrtya pravartate śāstram sthānamadhyāyah prakaranam vākyam vā*
The intention with which the author intends to write the book is called *Adhikarana*.

2. **yoga – yojana**
Yoga means conjunction of different words in an order rationally for getting proper understanding of the concept.

3. **hetvartho-** *nāmayadanyatrābhīhitamanyatropapadyate*
When a statement is made in a particular context, it applies if the situation is the same in other places.

4. **padārtha-** *padenārtha gamyate (viSaya:)*
The meaning of one word, two words or many words is known as *Padartha*.

5. **pradeśa-** *yeśāmarthānāmatibahutvāt sākalyenābhīdhānasyāśakyatvāt stokamucyate*
Pradeśa means that when there are many objectives of a topic and all of them are unable to mention at one place, and thus will be partially said as an illustration.

6. **Uddeśa:** *uddeśo nāma saṃkṣepābhīdhānam;*
The statement said in brief is called *Uddeśa*

7. **nirdeśa:** *nirdeśo nāma saṃkhyeyoktasya vivaraṇam;*
Detailed description of the briefly mentioned statement is known as *Nirdeśa*.

8. **vākyāśeṣa** - *yasmin sūtre lāghavikenārthādgamya mānamanuktapūraṇārthamadhyāhriyate*
Vakyaśeṣa means that in order to concise the statement sometimes the *Acāryās* deliberately omit certain words in a sentence however those words can be easily guessed according to the context.

9. **prayojanam-** *yadartham śāstrādi pravartate*
'*Prayojana*' means the objective or the purpose of doing things such as with what intention the treatise is composed.

10. **upadeśa – āptavacanam**
'*Upadeśa*' means the instructions of the preceptor.



11. **apadeśa**- *yadācāryah kiñcidar�ham pratijñāya hetumupadiśati*
Apadeśa' means adding reasons for making the statement.

12. **atideśa** - *yat kiñcidevārthajātamuktvā'nuktārthasādhanāya evamanyadapi pratyetavyamiti paribhāṣāyām sthāpayatinirNaya: yat nivAritasya arthasya pratiSThApanam*
Atideśa means to follow the indications specified elsewhere, even though not specified here.

13. **ekānta**- *ya ekameva pakṣamavyabhicārena śrayati nānyamnaikAnta:/anekAnta: anyatarapakSa anavatAraNam*
*The word that is said with certainty is called *Ekānta*.*

14. **apavarga** - *sākalyenotsrṣṭasya yatpunastadekadeśāpakarṣaṇam*
*Separation of limited things from the objects said as a whole, is called *Apavarga*.*

15. **viparyaya** - *yathopadiṣṭaviparyayena lakṣaṇādikaraṇam*
*Giving an example for reconfirmation of implied opposite action is called *Viparyaya*.*

16. **pūrvapakṣa**- *pratijñātārthasāmṛṣaṇam vākyam*
*The sentence which accuses in the proposition is called *Pūrvapakṣa*.*

17. **vidhāna**- *yatprakaraṇānupūrvam vidhānamāvekṣyate*
*That which is systematically explained by the *Acāryās* is called *Vidhāna*.*

18. **anumatam**- *anumataṁ nāma ekīyamatasyānivāraṇenānumananam*;- Acceptance of any one *Acāryās* opinion without objection is called *Anumata*.

19. **vyākhyāna**- *yanmādṛśebhyo viśiṣṭatarabuddhigamyam*
Explanation of the subject matter to make it understandable by persons of all three levels of intelligence.

20. **atītāvekṣaṇam**- *yadatikrāntamapekṣya prastutasya sādhanamucyate*
*Referring to statements made earlier in the present context is called *Atītāvekṣṇa*.*

21. **anāgatāpekṣā**- *atītāvekṣaṇāmīparitam*
Anāgatāvekṣāṇa means referring to later statements to understand the meaning of the present concept.

22. **ūhyam** - *yadapratibaddhaṁ granthe svayam prajñayā tarkayitvā yojyam*
Ūhya means to infer things which are not mentioned in the text by logically using the power of discernment to get proper information.

23. **samuccaya**- *samuccinoti iti*
*The sentence in which many expressions are included in one group by following this and this sequence, it is called *Samuccaya*.*

24. **nidarśanam**- *udāharanam*
*The word by which a fool and a scholar can gain knowledge of a subject equally is called *Nidarśana* or *Drstanta*.*

25. **nirvacana**- *nirṇayār�ham vacanam niruktam*
*An example which can be known by the knowledge of a scholar is called *Nirvacana*.*

26. **niyoga**- *yo yasyānuṣṭheyah nizcayena yojayatavyam*
Niyoga means instructions that must be followed.

27. **vikalpa**- *vividhaṁ kalpanam*
Vikalpa is a statement made for an alternative.

28. **pratyutsāra**- *yatropapattiṁ darśayantah parasparamatāni nivārayanti*
Pratyutsāra means refutation of others' views with reasoning.

29. **uddāra**- *śāstrārambhapratyākhyānādicodyasya samādhānam*
Uddāra means establishing the self-statement by pointing out the flaws in the statements of others and refuting them.

30. **sambhava**- *upapattiyasminnupapadyate anupadiṣṭe*
*A statement of the probability of manifestation of the location of any thing is known as *Sambhava*.*



DISCUSSION

Pañcāvayavavākyam:

pratijñā:

“*jñānam prati gacchati iti*” – that which moves towards the perfect knowledge. This can be considered as a hypothesis in modern terminology. Before creating a hypothesis, one must Create research. Here, the *tantrayukti* like *hetvartha*; *padārtha*; *aparvaga*; *viparyaya*; *pūrvapakṣa*; *vidhānam*, *vyākhyānam*, *samśaya*; *ūhyam*, *vikalpa*; *pratyutsāra*; *uddhāra*; *sambhava*; etc can be used to get the perfect topic and come closer to the specific subject for forming a research question. Here, as per the subject matter, one should interpret each term and apply it. Here, once again, the verification of the hypothesis can be done with the following terminologies like *pramā*, the right knowledge; *prameyam*, that which is eligible to be proved; *pramānam* the parameters and scales used for finding out the proof; *pramātā*, the eligibility of the researcher; *sādhya*, that which has to be proved; *sādhaka*, that which is proving; and *pakṣa*, the area in which it is going to be proved. While preparing *pratijñā*, the researcher verifies it with *hetu* and uses perfect language to avoid further questions out of it. Generally, the *pratijñā* can be understood as a hypothesis in modern research. In modern research Null Hypothesis must also be written. This is *vādamārgas* termed as *pratiṣṭhāpanā*. The researcher should collect the literature in support of his hypotheses as well as that of the null hypothesis before starting the research to assure the success in proving the hypothesis. This is told in the *vādamārga* in the *vimanasthana* of *Carakasamhita*.

hetu:

is used in the *Nyaya* philosophy for the scientific interpretation of the *pratijñā* as per the *kāryakāranasiddhānta* established by the *sāṅkhya* philosophy. There are various types of *hetu* or causes. They are *samavāyi kāraṇam*, *asamavāyi kāraṇam*, *nimitta kāraṇam*, *upādhi kāraṇam*, *samipavartti kāraṇam* and *dūravarttikāraṇam*. According to the theory of cause-and-effect theory every effect should have a cause, and the cause will be present in the effect in one or another form. So, from the effect, the cause can be understood. There are so many reasons that obstruct the identification of the real cause. The *samavāyi kāraṇa* is very important in producing the effect. *Asamavāyi karana* is only a supportive cause to produce an effect. *Nimitta karana* is only an instrument that causes to produce the effect. Sometimes, some of the causes will appear like the main cause. It is called *hetvābhāsa*. There is a *tantrayukti* called *sambhava*, which means that only one effect is possible from a cause. Only that cause can produce that effect. There is no possibility for other causes. But sometimes this will not happen because some secondary causes obstruct the process. Even if an effective medicine is given for a condition there the effect is not obtained. Immediately, the researcher should think about the *upalabdhidhikarana*, which is responsible for that condition. Here, the research should validate the cause from the effect. In many cases, there will be an immediate cause for the effect. But there will be a distant cause also. Here, the researcher should validate both the cases, but should handle the immediate cause and then the distant cause. All these improve the clarity and validity of the research. There are so many other factors that play different role to obstruct the findings. Like time place etc. So, the researcher should have enough literature in support of the research topic.

udāharanam:

These are the findings of the researcher. All the findings as per the area and topic of the research, the findings should be recorded based on various *pramāṇas* such as perception, inference, etc. All the laboratory findings, clinical findings, literary findings, etc, have to be properly collected and grouped based on *sāmānya* and *viśeṣa*. Means that in support of the hypothesis and support of the null hypothesis. The data that are in support of the null hypothesis are to be once again verified with the tools of learning *tantrayukti*. They should also be verified with the proper causes. This helps to find out the exceptions.

upanayanam:

This is the discussion part in modern research. Here, the researcher should discuss how the data support the hypothesis using the tools *tantrayukti*, relating or logically interpreting the findings with the theoretical data collected. All the exceptions found during the research should also be mentioned and discussed. The researcher should establish the data that supports the hypothesis and prove that the data found in support of the null hypothesis are only exceptions because of the influence of many other factors that are not coming under the research topic. While establishing this, the researcher can use the four types of *siddhāntās* mentioned in *vādamārgas*.

nigamanam:

This is the conclusion of the research. It should be concise and clear. *adhikaraya tantrayukti* gives importance to the context and contextual subject while explaining about relation between the research topic and the theories that are already established, and how they support establishing the present research topic.

yoga: is generally understood as a tool for wisely arranging the data to establish the correctness of the *pramānās* and later relating the research findings to the conclusion with the support of the standard scales or tools called *pramānās*. It includes the logical interpretation with the support of the literary data and the research findings.

hetvartha: This is a very important theory in all types of research. Cause and effect relationship. This *tantrayukti* helps to establish many principles with the support of inference by relating the already established to the present findings.

padārtha: This gives importance to the terminologies used in different contexts and how they could be explained in a different context in a different way.

pradeśa: There is a habit of writing or specifying only the very important topics, and they can be explained largely by adding many related bits of knowledge with the support of the topic explained. This is very useful to create a research question as well as to find the untold information from the told information.

uddeśa: This *tantrayukti* helps the researcher to create terms or use the language concisely to express a lot of information within it.

nirdeśa: is another *tantrayukti* to standardize the way of presentation of the research findings with a required description.

vākyāśeṣa: This is for understanding the untold but important terms which can be used for creating research questions and research findings.

Prayojanam: This is the *tantrayukti* for broadening the area of thinking to relate topics concerning the purpose of that topic.

upadeśa: This *tantrayukti* is very important for Indian sciences because many of the established and fruitful findings are passed from generation to generation without scientific interpretation or evidence-based data. This is a standard scale or tool to establish many findings.

apadeśa: This helps the presentation clearer by reasoning the findings in the discussion.

atideśa: This helps interpret the untold, but can be assumed from the told while collecting the literature.

arthāpatti: This *tantrayukti* also helps the researcher to read between the lines to create supporting literature as well as to create new areas of research.

ekānta; naikānta:/anekānta; aparvaga; viparyaya; pūrvapakṣa; samśaya; atītāvekṣaṇam; anāgatāvekṣaṇam; svasaṃjñā; ūhyam samuccaya: all these *tantrayuktis* helps a researcher in collecting the literature, evidence, etc., and to



create research questions during the research process and reasoning them to clarify the main research topics and related findings,

vidhānam-, vyākhyānam, nidarśanam, nirvacanam, niyoga:, vikalpa:, pratyutsāra:, uddhāra:

These *tantrayuktis* are very specific about the presentation of the findings and discussion.

The forty-one *vādamargas* are the guidance for presenting a research thesis without any error and specific to the topic. These are wonderful and highly scientific tools for the presentation of the thesis.

Modern research

Types of Research:

- Descriptive research and Analytical Research:

Both are there in Indian sciences. In *vādamargas*. there are four types of *siddhāntas* (principles) explained. The descriptive research methodology is applied here to reach the principles at the end of the research. *Sarvatantra Siddhanta, pratitantra siddhānta, and adhikaranasiddhanta*. Here the data will be collected and then reach into a principle.

- Applied Research:

In *abhyupagamasiddhanta*, the researcher finds a solution for a problem by modifying the already existing factors with some additions or subtractions.

The research methods, like analysis of documents, non-participation, direct observation, preparation of observations, mass observations, case study, etc, are used as textual methods to present the topics more clearly. Tools such as *viśeṣa* and *sāmānya* for sorting research findings to group substances, diseases, treatments, etc in Ayurveda. Like that in every science.

Tantrayuktis and the terminologies in modern research:

Adhikarana- The area of the research and the area from which the literature has to be collected, and the research question has to be created.

yogatantrayukti- logical interpretation and arrangements of the collected literature, research findings to reach the correct conclusion.

Hetvarthatantrayukti- verification of the relevance of the data's collected with the hypothesis.

Uddesatantrayukti- Research question or the Abstract of the research

Nirdesatantrayukti- The detailed research and the descriptions in the discussions

Pradesatantrayukti- Partial enunciating while sampling etc.

Prayojanatantrayukti- The aims and objectives of the research or the technique to justify the data collected to prove the hypothesis or the conclusion.

Apadesatantrayukti- Reasoning the findings during the discussion

Apavargatantrayukti- Exclusion criteria and showing the exceptions in the findings.

Nirnayatantrayukti- Conclusion



Vidhanatantrayukti – presentation

CONCLUSION

The Indian knowledge system has followed a highly scientific approach and methodology in the process of creating various scientific treatises in various branches of science and even in literature. They explained them as textual tools to understand the subject matter. All scientific treatises mentioned the methodology they followed in their scientific studies. All six schools of philosophy followed their methodology to establish their findings. Critical analysis of all these tools proved that all the steps of research explained in the modern research methodology are there in the ancient textual methodology followed by various sciences in the Indian Knowledge system. The methodology followed in the Indian knowledge system is more evident than the modern research methodology. The application of modern research methodology in the research of the Indian Knowledge System has several limitations. It is found that the research methodology based on the textual methodology mentioned in Indian scientific treatises is more research-friendly and evidence-based.

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