



The Inductive Research Method in Early Islamic Tradition based on Ibn Tufayl's Work - *Hayy Ibn Yaqzan*

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Abstract

The inductive method of research has played a significant role in scientific progress throughout history. It has been proclaimed in the history of science texts that the inductive research method was first introduced by Francis Bacon (1561-1626), a western scholar. However, there are ample evidences to show that this method was earlier developed and applied by Muslim scholars about 500 years before him. For instance, Ibn-Tufayl (1100-1185), a Muslim scholar and philosopher referred to the components of the inductive research method in his well-known novel, *Hayy Ibn Yaqzan* (literally, Alive son of Awake). The current paper aims to explore the features of the inductive research method mooted in the aforesaid novel. The analysis showed that Muslim scientists were aware of the features of the inductive research method, and its application was evident in their works as the case demonstrated by Ibn Tufayl.

Keywords: *Inductive research method, Ibn Tufayl, Hayy Ibn Yaqzan, epistemology.*

Abstrak

Di sepanjang sejarah perkembangan saintifik, kaedah induktif bagi penyelidikan telah memainkan peranan yang sangat penting. Dalam sejarah penulisan teks sains, Francis Bacon (1561-1626), seorang sarjana Barat, diisytiharkan sebagai orang pertama yang memperkenalkan kaedah penyelidikan induktif. Walau bagaimanapun, terdapat cukup bukti yang menunjukkan bahawa kaedah ini telah berkembang dan digunakan oleh sarjana Islam kira-kira 500 tahun lebih awal sebelumnya. Sebagai contoh, Ibnu Tufayl (1100-1185), seorang sarjana Islam dan ahli falsafah merujuk kepada beberapa komponen kaedah penyelidikan induktif dalam novel beliau yang tersohor, iaitu, *Hayy Ibn Yaqzan* (secara harfiah bermakna, *Hidup anak lelaki Sedar*). Kajian ini bertujuan untuk meneroka ciri-ciri kaedah penyelidikan induktif yang dikemukakan dalam novel tersebut. Analisis ini menunjukkan bahawa ahli-ahli sains Islam menyedari ciri-ciri berkaitan dengan kaedah penyelidikan induktif, dan penggunaannya jelas terbukti dalam karya mereka seperti yang ditunjukkan oleh Ibn Tufayl.

Kata kunci: *kaedah penyelidikan induktif, Ibn Tufayl, Hayy Ibn Yaqzan, epistemologi.*

Introduction

Islam is the path and the religion of "knowledge". It exhorts Muslims to gain knowledge and to investigate natural phenomena systematically (Sardar, 1998). Throughout the Qur'an and Sunnah, a strong emphasis on the value of knowledge and research can be found. Khan (2012) states that around 200 verses out of the total verses, 6347, of the Qur'an refer to obligation offer of prayers, while more than 600 verses encourage the believers to ponder on the mysteries of

nature and reflect on Allah's creation and to use their reason. The same idea has been earlier explicated by Al-Najjar (1988) who maintained that the Holy Qur'an "has perpetually, and in many verses directed the human beings to observe the universe and try to understand its miraculous structure because by so doing one can get to know the Creator, understand the laws governing the universe and hence use it for bettering life on earth" (p.146). These are the major purposes of scientific research (Shi, 2008). To achieve these purposes, there is a need to use proper and systematic research methods so that the results could be replicated by somebody else; for instance, the deductive and inductive research methods. The former works from general theory to specific or particular examples, while the latter works from

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specific examples to a general theory (Elo & Kyngas, 2008). The inductive research method, which is the focus of this paper, in its modern form was used much earlier by Muslim scholars in their experiments which were conducted to understand natural phenomena that they observed. In his book, Sarton's (1951) evidently articulated that Muslim scholars first used experimentation and observation systematically, and they played a significant role in the history of science.

The purpose of the paper

The Islamic world has contributed significantly to the global civilization. During the first half of the Middle Ages, many Muslim scientists and scholars made immense contribution to human progress and development in many branches of science more than others. They transferred human civilization to Europe throughout the era of Muslims in Spain (named as *Al-Andalus*) (Sarton, 1951; Hussain, 1968; Abu-Samrah & Al-barghothee, 2008). Abu-Samrah & Al-barghothee (2008) explored the role of Muslim scholars in different aspects of science, especially the scientific research methodology. They showed that Muslim scholars were very creative in the field of scientific methodology and they discovered and used most of the current scientific research methods. One of the major contributions that Muslims made is the application of scientific research methods in their experiments, which is, however, either completely ignored or attributed to other scholars.

For example, many of western scholars assert that Bacon (1561- 1626) was the first one who talked about scientific research methods, mainly the inductive method. Faulkner (1993) argued that the progressive civilization was set forth by Francis Bacon, through his famous writings on experimental science. Thus, this paper attempts to shed some light on the scientific research method (inductive method) used by Muslim scientists 500 years before Francis Bacon. The study is based on the famous philosophical novel, *Hayy Ibn Yaqzan* written by Ibn Tufayl, one of the well-known Muslim scholars. The analytical research method was utilized to analyze and identify the features of the inductive research method mooted in '*Hayy Ibn Yaqzan* novel.

It is important to note that the novel appeared about 500 years before Daniel Defoe wrote his novel, *Robinson Crusoe*. Nevertheless, *Hayy Ibn Yaqzan* has not received its right in study and analysis, compared with *Robinson Crusoe*, despite the enormous similarity between them. However, some studies have addressed and analyzed the novel from either philosophical or religious perspectives. Among them are Deniz (2008) who discussed and linked the novel

to the Qur'an, and Germann (nd.) who studied the concept of philosophy in the novel. To the best of our knowledge, no study on the novel has been entirely addressed and analyzed from the scientific perspective, which is the focus of this paper.

The Inductive Research Method

Science is a never-ending and changing process through which the material nature of the universe is investigated and explored. Medewar (1996) maintained that no single, identifiable method could be applied in all branches of science to answer, or find out solutions to problems. However, both induction and deduction forms of logic are aids that help researchers to do so. In this respect, Ishtaiyah (1998) asserted that the scientific research method (inductive method) is a regular way to ask and answer questions by making observation and doing experiments using the following steps: feel or sense the problem and ask questions about the problem, construct hypothesis, collect data about the problem, test the hypothesis through experiment, and analyze results. If the hypothesis is true, it can be accepted and vice-versa, whereby one should think again to construct new hypothesis. The steps in conducting inductive research are shown in Figure 1, which may also help researchers to evaluate their researches or experiments objectively.

Hayy Ibn Yaqzan

Ibn Thufayl's novel entitled *Hayy Ibn Yaqzan* describes the life of an infant called *Hayy Ibn Yaqzan* who lived in an uninhabited island alone with the wild animals. During his life he sought to understand his being and existence by exploring the universe through using his senses and reason. To help readers understand the paper and its discussion, a brief and comprehensive summary of the novel drawn from Raihan (2012) is hereby given. Readers may also see Atiyeh's translation (1963) of the novel for greater details.

The novel of Hayy Ibn Yaqzan takes place on an island uninhabited by human beings. Hayy is found alone as an infant. Philosophers were of the opinion that he was born spontaneously when the mixture of elements reached an equilibrium state, making it possible for this mixture to receive a human soul from the divine world. Traditionalists believed that he was the son of a woman who chose to keep her marriage to her relative, Yaqzan, secret from her brother who ruled a neighboring island and did not find any man qualified to marry his sister. After breastfeeding Hayy well, she put him in a box and threw it into the waters, which took him to the uninhabited island. A deero

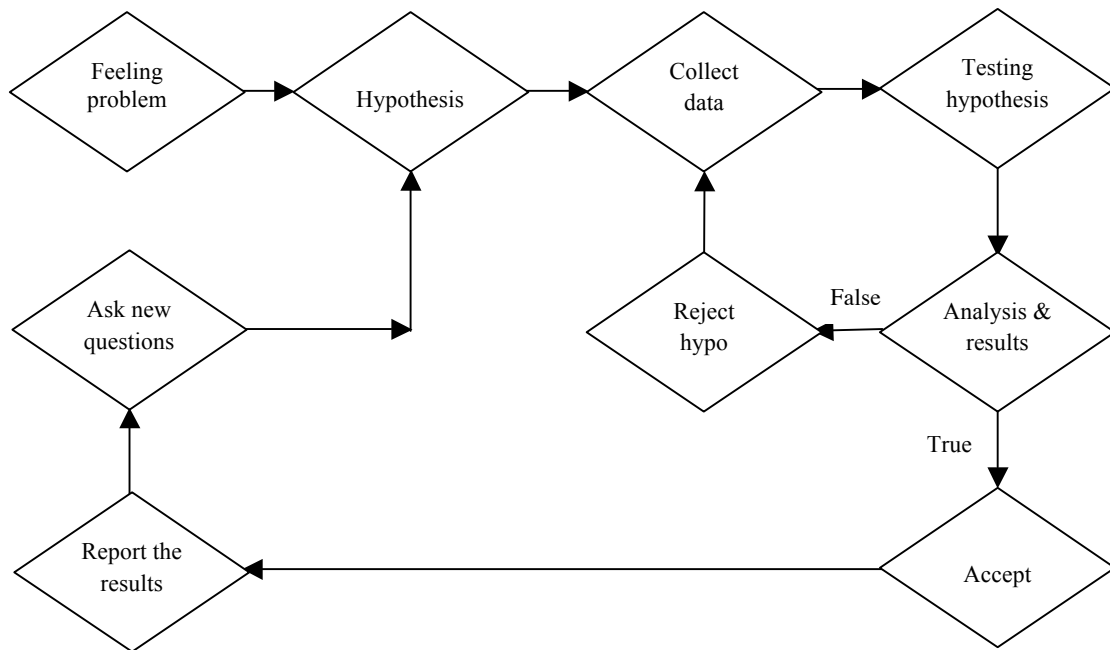


Figure 1: Steps in Inductive Research Method

had just lost her son and was still experiencing the feelings of motherhood heard Hayy's cries.

She suckled him, protected him from harmful things and took care of him until she died when he was seven years of age. By then he had learned to imitate other animals in speech, and he covered parts of his body with leaves after noticing that those animal parts are covered with hair or feathers. The deer's death transformed Hayy's life from one of dependency to one of exploration and discovery. In an effort to find out the reason for the deer's death, he dissected her with sharp stones and dry reeds. Noticing that every bodily organ has a proper function and that the left cavity of her heart was empty, he concluded that the source of life must have been in the cavity, and must have abandoned it. He reflected on the nature of this vital thing, its link to the body, its source, the place to which it has departed, the manner of its departure and so on. He realized that it was not the body but this vital entity that was the deer and the source of its actions.

With this realization he lost interest in the deer's body. While he could not decipher the nature of this vital thing, he observed that the shape of all deer was similar to that of his mother. From this he concluded that all deer were managed by something similar to the vital thing that managed his mother's life. After his discovery of life, he came across a fire. He noticed that, contrary to other natural objects, which move downward, fire moves upward. This indicated to him

that the essence of fire is other than that of natural things.

He continued to investigate other parts of nature: animal organs, their arrangement, number, size and position, as well as the qualities that animals, plants and inanimate things have in common and those that are proper to each of them. Through continued reasoning he grasped the concepts of matter and form, cause and effect, unity and multiplicity, as well as other general concepts concerning the earth and the heavens. Asking himself whether the world is eternal or produced in time, he found that there are two plausible answers to this question, which he left unanswered. But in each case he was led to the conclusion that there exists a necessary being who is the creator of all other being and who is exempt from all corporeal qualities and inaccessible to the senses or the imagination. He maintains the world has a creator who is superior to it in the order of His being as well as by His eternity. Hayy then decided to determine the degree of His power on all created things, also His eternity and omnipotence. He found Him, furthermore, endowed with complete perfection and exempt from all imperfection. When Hayy reached his thirty-fifth year, he was completely absorbed in thinking about this creator. Sure of the existence of a Perfect Being. Hayy wanted to find out how he came to know Him.

He realized that he could not have known Him through the senses. These, being divisible, were not

capable of knowing what indivisible, spiritual was, and not subject to corruption. He must have come to know Him through something that must be the very essence of his own being, that was, his soul. This, consequently, was indivisible, spiritual, and not subject to corruption. He thus came to know that the Necessary Being is perfect and exempt from all privation, and that He is known by something whose nature is unlike the physical/material bodies. This led him to see that the perfection of the soul consists in the constant use of reason in this life. If one does not use reason, his soul becomes nothingness after death. Also, if he has known the Necessary Being, but turned away from Him in order to follow his passions, he will be deprived of the intuitive vision and will suffer infinitely, whereas if one turns wholly toward God and dies while enjoying the intuitive vision, he will enjoy eternal bliss.

These considerations led Hayy to seek divine ecstasy by concentrating his thoughts on the Necessary Being. However, the senses, sensible images, plus the physical needs of the body, would obstruct him. He was afraid death would overtake him while he was still being distracted from the Necessary Being. Hoping to find a remedy for his plight, he examined the actions and goals of all animals to find out whether they seek after God so that he could learn from them how to save himself. To his dismay, he discovered that they do not seek after God. He next examined the celestial bodies and found out that they possess an intelligent substance, like his, and that they eternally behold the Necessary Being. He realized that he resembles, on the one hand, the "Necessary Being" through that noble part of himself - the immaterial intelligent substance, his soul - and, on the other, the animals through that vile part of himself that is his body.

From this he concluded that his action should be carried out on three levels: (1) the actions emulating those of the animals, (2) the actions emulating the celestial bodies, and (3) the actions emulating the Necessary Being. It became clear to him that his ultimate end consists in the third emulation, that this is not obtained without long exercise and practice in the second, and that the continuation of the second depends on his first emulation. And he also realized that the first emulation, although necessary, is as such a hindrance and help only accidentally. Consequently, he forced himself to reduce the first emulation to bare necessity, that is, the strictly required amount below which the animal spirit would not subsist.

In the opposite island where Hayy was born, there existed religion conveyed by an earlier prophet. The religion spread widely in the island. There, lived two

men who love goodness and virtue, namely Salaman and Absal. They both learnt about the religion and were very faithful to it, by practicing their religious rituals and reading religious texts. Absal liked to isolate himself from the world, whereas Salaman was interested in the community in order to practice the religion. Because of their difference in thought, Absal decided to separate from Salaman and left the island. He went to the opposite island and spent his time alone in worshipping the Absolute Truth.

At the age of 50, when Hayy had not communicate with anyone except himself, he met Absal; an anchorite refugee from a land of conventional 'true believers'. Absal was a perfect model of a religious man, a believer who has learnt many languages to gain mastery of scriptural texts. His first reaction was a deep sense of fear for his faith as he encountered an exotic being (Hayy). But his fears were dropped soon as he came to know that Hayy did not have a clue of any language. In good faith he tried to teach him to speak and communicate in order to make him aware of knowledge and religion. However he soon discovered that Hayy was already aware of the 'truth'; to foresee which, his own (Absal's) intellect bears nothing except revealed symbols. Hayy formally proselytized judging Absal's good intentions and the trueness of his message and as the duo associate with one another, Absal introduced Hayy to his culture and people. As Hayy got familiarized with this civilization, two basic questions continue to puzzle him in great deal. Firstly, "Why people must need symbols to assimilate and express the knowledge of the Divine?" and continue understanding matters of Divine world literally. Secondly, being completely oblivious to ritualistic sense, he continued to wonder why there is an obligation to indulge one's self in rituals of prayer and purity. He finally decided to accompany Absal to his land, thinking that it might be through him that people encompass the true vision and 'realize' truth rather than 'believing' it with their seemingly narrow kens.

His audience on the other hand, reacted in their uneasiness and being intellectual slaves to their prejudices closed their ears. He consequently realized that these people were unable to go beyond their usual appetites and inclination. He also grasped that masses of the world are only capable to receive through symbols and regulatory laws rather than being receptive to unstained and plain truth. Both men returned back to their isolated world but this time Hayy became the teacher and Absal as his disciple. They continued searching their ecstasies until they met their ends".

The Inductive Research Method in Hayy Ibn Yaqzan

From the novel, it has been observed that throughout his journey of life, Hayy used the inductive research method to discover and understand the natural world where he lived. Below is a review of two situations from the novel linked to the inductive research method.

The first situation deals with the deer's (his mother) death, and his attempts to know the causes or the reasons of her death. The novel states that

All her movements and bodily functions came to standstill. When the boy saw her in such a state, he was beside himself with grief. His soul seemed to overflow with sorrow. He tried to call her with the call she always answered, shouted as loud as he could, but saw not the faintest flicker of life. He peered into her eyes and ears, but no damage was apparent. In the same way he examined all her parts but could find nothing wrong with any of them. He hoped to discover the place where she was hurt so he could take away the hurt and allow her to recover, but he could not even make a start; he was powerless (Translated by Goodman, 1991, p. 111).

Reading this extract thoroughly, one would notice that it includes all the steps of an inductive research. For instance, the first step in scientific research is feeling with the problem, which leads to ask questions about this problem. Hayy felt that the movements and the bodily functions of her mother were not normal, so he asks himself what happened to his mother. Then he started data collection by calling her and peering into her eyes and ears, and he noticed that there was no damage apparent. This represents the second step of the inductive research method. After that, he constructed a hypothesis that the cause of what happened to her mother might be on the other parts of her mother body. Hence, he tested this hypothesis by examining all her other parts, and he found that nothing was wrong or damaged with any of them. The novel continues showing how Hayy was applying the inductive research method, hoping to find the causes of his mother death. Apparently, Ibn Tufayl described the inductive research method through the behaviors of Hayy Ibn Yaqzan, and this description is repeated in many places throughout Hayy's life in the novel.

...that he knew that when he shut his eyes or covered them, he saw nothing until the obstruction removed; if he stopped his ears with his fingers he could not hear until the obstacle was gone; and he held his nose he would smell nothing until the passageway was clear again. These observations led him to believe that not only his senses, but every one of his other bodily functions was liable to obstructions that might block its work. When the block was removed it would return to its normal functioning. But when he had examined all her external organs and found visible wound or damage, considering meanwhile that her inactivity was not confined to one part but spread throughout the body, it dawned on him that the hurt must be in some organ unseen within the body, without which none of external parts could function. When that organ had been hurt, the harm was general. No part of the body could carry on its work. Hayy hoped that if he could find that organ and removed whatever had lodged in it, it would revert to normal, its benefits would once more flow to the rest of the body and all the bodily functions would resume (Translated by Goodman, 1991).

In this extract, it is evident that Hayy put forth several hypotheses and tested each of them. When they were not true, he reflected and began to construct new ones. This behavior is also directly related to scientific research. In the first situation Hayy hypothesized that the problem was in the external organs of the deer's, but when he examined the external parts, he found nothing wrong in any of them. Therefore, he rejected his hypothesis and began reflecting again to construct a new hypothesis. In this context, it is important to infer that Ibn Tufayl pointed to a main characteristic that any researcher should possess, which is patience. Hayy had this characteristic because he did not give up when his first hypotheses got wrong, and he kept on searching for a convincing answer to his mother's death. He also conducted a dissection process to the body of the deer. The novel continues showing other interesting examples of inductive research method.

...that a fire broke out one day by friction in a bed of reeds. When Hayy first saw it the sight terrified him. He had never seen anything like it. For some time he stood staring at it, gradually moving nearer, awestruck by its piercing light and the way it attacked, overwhelmed, and turned to flame everything it touched. Carried away by his amazement, and by the courage, not to say audacity, God had compounded with his nature, Hayy reached out and tried to grasp a piece of it. But when he touched it, it burnt his hand, and he could not hold on to it. Then he got the idea of taking a brand that was not wholly on fire. He picked it up by the end that was not burning, leaving the fire at the other end. This he could manage with ease, so he took it home for he had moved into a cave, which seemed to him a fine place to live. Then he tested the power of fire on everything by throwing things in and watching how quickly or slowly it overwhelmed them, depending on the combustibility of the material. One thing he threw in, purely to experiment with its propensity to burn, was a fish that had been cast up on the beach by the sea. As it began to roast and the savory odors spread, his appetite was aroused. He nibbled it and liked it. In this way he learned to eat meat and practiced hunting and fishing until he became quite skilled in both. He liked fire even more now that it brought him good things to eat he had never had before (Translated by Goodman, 1991).

In analyzing the above extract, it is found that Hayy used the inductive research method to explore fire and to understand its nature. He also investigated the influence of fire on other materials. For example, he tested the power of fire on everything by throwing things in it. This situation shows an experiment that includes all the steps of the inductive research method. An interesting point is that the application of inductive research method led to the betterment of his life; he learned to eat meat and practiced hunting and fishing to take his food.

Conclusion

There are two types of scientific research method, inductive and deductive methods. Each one has its own features. Both are important, and the research nature determines which type to use. The inductive research is based on reasoning or thought which turns an observation or a thought into a general theory. In other words, a researcher's thought path goes from specific to general. In this particular novel, Hayy used mostly the inductive research method in the same way

that is currently used. He used reason and observation to understand and develop the world around him. Ibn Tufayl's novel is a clear example that indicates that Muslim scientists were aware and have used the scientific research method long time ago, during the Golden age of the Islamic Civilization, while European countries were suffering from the Dark ages. In fact, this novel is very rich as it has philosophical, religious, educational and scientific implications. It is only an example of other many works written by earlier Muslims, which need deep analysis and investigation. It is recommended that other researchers unearth them. This paper is only a small attempt, but a crucial step towards understanding the precious and prosperous legacy of Muslim history.

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ⁱ Abu Bakr Tufayl was born shortly after the beginning of the twelfth century A.D in the little Spanish town of Guadix, about 50 miles northeast of Granada. He was well educated and taught medicine as well as practiced it. He was a minister to the governor of Granada and served several members of the *Al-mohad* dynasty in the same capacity. He wrote a couple of works but only one of his philosophical work, *Hayy Ibn Yaqzan* survives. In 1185 Ibn Tufayl died at Marrakesh (Goodman, 1991).