

SCIENTIFIC AND CRITICAL THINKING IN AL-GHAZALI'S THOUGHT

Ibrahim Abu Bakar*

Abstrak

Tulisan ini menjelaskan tentang tiga subyek pembahasan yang sangat penting bagi pengembangan pemikiran kritis dan ilmiah di antara umat Islam. Tulisan ini terdiri dari tiga bagian; bagian pertama memperkenalkan pemikiran kritis dan ilmiah serta posisi al Ghazali di mata beberapa sarjana muslim, bagian kedua menjelaskan secara umum tentang pemikiran filosof muslim tentang matematika, logika, dan filsafat, dan bagian ketiga menjelaskan pemikiran al Ghazali tentang matematika, logika, dan filsafat dengan merujuk pada bukunya "Ihya' Ulum al Din".

الخلاصة

تبحث هذا البحث في ثلاثة أمور مهمة لتطور الأفكار النقدية العلمية بين المسلمين. وكانت هذا البحث يتكون من ثلاثة أقسام: الأول يعرف الفكرة النقدية العلمية و موقع الغزالي عند نظر العالمين, والثاني يبحث أفكار الفلاسفة عن الرياضيات و المنطق و الفلسفة, و الثالث يبين أفكار الغزالي عن الرياضيات و المنطق والفلسفة مع الرجوع إلى كتابه "إحياء علوم الدين".

* Professor of Universiti Kebangsaan Malaysia (UKM)

A. Introduction

This paper does not intend to look into the definition of scientific and critical thinking in the thought of Abu Hamid al-Ghazali (d. 505 A.H./ 1111 A.C.). As far as I know, al-Ghazali does not write about the definition of scientific and critical thinking. However, his thought is considered very critical toward philosophy and *'ilm al-kalam* (Muslim speculative theology or the *Kalam*). This paper presents al-Ghazali's thought of mathematics, logic and philosophy on the ground that the three subjects are considered crucial for the development of scientific and critical thinking among Muslims. This paper consists of three parts: the first part introduces scientific and critical thinking and al-Ghazali's identities in the eyes of some scholars; the second part presents Muslim philosophers' thought of mathematics, logic and philosophy in general, and the third part presents al-Ghazali's thought of mathematics, logic and philosophy with special reference to his *Ihya' 'ulum al-din*.

B. Scientific and Critical Thinking: The Position of al -Ghazali

Since the topic of the paper is about scientific and critical thinking, it is probably relevant to briefly describe the natures of scientific thinking and critical thinking in general. It is important to have some ideas as to what scientific thinking consists of. D. Kuhn sees that one of the main goals of science education is to foster skills of scientific thinking. She writes, "science educators have long been in agreement that a major goal of science education ought to be fostering skills of scientific thinking..."¹ According to her, "skills in coordinating theories and evidence arguably are the most central, essential, and general skills that define scientific thinking." Her view is based on what she sees as a central premise, which underlies science. For her, the central premise underlying science is "that scientific theories stand in relation to actual or potential bodies of evidence, against which they can be evaluated. Reciprocally, scientific 'facts' stand in relation to one or more actual or potential theories that offer a vehicle for their organization and interpretation."²

It has been accepted by some science educators that they have to teach their student's scientific knowledge or concepts as well as methods of scientific thinking or reasoning. Some scholars find the methods of scientific thinking in logic. Logic is considered to be a good method for scientific thinking. From this point of view, scientific thinking is seen identical with logical thinking since both types of thinking consider and arrange the available infor-

¹ Deanna Kuhn, 1988, "Introduction" in *The Development of Scientific Thinking Skills*, Academic Press, San Diego California, p. 3.

² *Ibid.*

mation or data in a logical and scientific manner in order to arrive at any temporary or final conclusions. "Two different logical systems have been suggested as models of scientific thinking. One is the standard logic of deductive argument, reasoning from premises to conclusion. The other is the combinatorial logic proposed by Inhelder and Piaget (1958) as characterizing the structure of the cognitive stage of formal operations."³

Some scholars see that scientific thinking has the task to find a solution for a problem in a scientific way and it is considered as problem solving. Scientific traditional activity is broadly divided into three major phases or stages namely "hypothesis generation, experimentation, and inference; investigations of scientific thinking are frequently organized around these divisions. These three phases of scientific activity are also found in problem solving activity. Some other scholars see that scientific thinking is found in induction. They think that scientists learn about the nature of the world through the process of inductive reasoning. Holland, Holyoak, Nisbett and Thagard (1986) are said to be the main exponents of the idea of scientific thinking as induction. Their idea basically says that scientific thinking involves induction."⁴

Both deductive and inductive methods are considered logical methods. If they are also considered methods for scientific thinking; scientific thinking is greatly influenced by logic. It is probably true to conclude that scientific thinking can be defined as a type of reasoning which uses a scientific method; it proceeds from observable facts of experience to reasonable explanations for those facts. For Copi, "the scientific method is not confined to professional scientists: anyone can be said to be proceeding scientifically who follows the general pattern of reasoning from evidence to conclusions that can be tested by experience."

Regarding the definition of critical thinking, Dr. Nor Azizah Mohd Salleh says, "Critical thinking is the ability to make rational judgement given various alternatives to do things. To be critical thinker is to be open-minded, willing to listen to diverse ideas before making a conclusion; able to question generalizations and assumptions underlying ideas, beliefs and actions for justification"⁵ Another definition of critical thinking is from Barbara Warnick and Edward S. Inch who write that "Critical thinking includes many specific skills, such as analyzing and evaluating evidence, identifying relevant questions, drawing sound inferences, generating plausible solutions and hypotheses, detecting errors in others' reasoning, stating implicit assumptions, and

³ Deanna Kuhn, *op.cit.*, p. 15.

⁴ *Ibid.*, p. 21-23.

⁵ Nor Azizah Mohd Salleh, 1995, "Strategies to implement critical thinking in adult and teacher-education" in *Prosiding Konvensyen Antara Bangsa Kecemerlangan Berfikir*, Fakulti Pendidikan Universiti Kebangsaan Malaysia, Bangi, p. 260.

understanding the implications of an argument".⁶ Logic also requires many important skills and some of them are also required for the critical thinking especially the skills to distinguish between good or correct reasoning and bad or incorrect one, to understand the methods, principles and laws or rules of reasoning Copi provides us with three definitions of logic. First, logic is "the study of the methods and principles used to distinguish good (correct) from bad (incorrect) reasoning." Second, logic is "the science of laws of thought", and third, logic is "the science of reasoning". Copi himself prefers the first definition of logic in comparison with the second and third definitions.

Who is Abu Hamid al-Ghazali in the eyes of scholars who have studied and written about him? The answer from M. Saeed Sheikh is as follows: "Al-Ghazali occupies a position unique in the history of Muslim religious and philosophical thought by whatever standard we may judge him: breadth of learning, originality, or influence. He has been acclaimed as the Proof of Islam (*hujjat al-Islam*), the Ornament of Faith (*zain al-din*) and the Renewer of Religion (*mujaddid*).... He was in turn a canon-lawyer and a scholastic, a philosopher and a skeptic, a mystic and a theologian, a traditionalist and a moralist. His position as a theologian of Islam is undoubtedly the most eminent".⁷ The answer from D. Collinson and R. Wilkinson says that "Al-Ghazali was a philosopher of great originality and critical acumen. He was deeply religious, a mystic as well as a penetratingly analytical thinker; a skeptic as well as a man of faith".⁸ The answer from M. Campanini says that al-Ghazali "was essentially a theologian, a mystic and a jurist" and al-Ghazali "did not consider himself a philosopher, nor liked to be considered as such. Yet it is interesting that the Christian thinkers of the Middle Ages....looked on him as a *faylasuf* like Ibn Sina or Ibn Rushd".⁹ Muhammad Lutfi Jam'ah includes al-Ghazali among Muslim philosophers. He presents the history of Muslim philosophers consisting of al-Kindi, al-Farabi, al-Ghazali, Ibn Bajah, Ibn Tufayl, Ibn Rushd, Ibn Khaldun, Ikhwan al-Safa, Ibn al-Haytham, Mahyuddin ibn al-'Arabi and Ibn Miskawayh in his work.¹⁰ W. M. Watt looks at al-Ghazali as a Muslim theologian who privately read and understood the philosophy of al-Farabi and Ibn Sina. Watt writes that al-Ghazali "has been acclaimed by both Muslim and European scholars as the greatest Muslim after Muhammad. Whether this judgement is in fact sound is a par-

⁶ Barbara Warnick and Edward ., 1994, *Critical Thinking and Communication: The Use of Reason in Argument*, Macmillan Publishing Company, New York, p.11.

⁷ M. Saeed Sheikh, 1963, "Al-Ghazali : Metaphysics" in *A History of Muslim Philosophy*, Otto Harrassowitz, Wiesbaden, p. 581.

⁸ Diane Collinson and Robert Wilkinson, 2000, *Thirty-Five Oriental Philosophers*, Routledge, London, p. 26.

⁹ Massimo Campanini, "Al-Ghazali" in *History of Islamic Philosophy*, Arayeh Cultural, Tehran, p. 258.

¹⁰ Muhammad Lutfi Jam'ah, *Tarikh falsafah al-islam fi al-mashriq wa al-maghrib*, al-Maktabah al-'Ilmiyyah, S.I., p. 67.

ticularly difficult question for European scholars to settle, since for most of them al-Ghazali is undoubtedly the most congenial and most approachable of Muslim theological writers.... The theologian was born in Tus (near the modern Meshed in Persia) in 1058, and received his early education there".¹¹ For Watt, al-Ghazali did not study philosophy from philosophical teachers. Watt writes that al-Ghazali "was by private reading gaining a thorough grasp of the philosophy of al-Farabi and Avicenna — something no theologian had hitherto done".¹² However, Majid Fakhry does not agree with Watt on this point. For M. Fakhry, al-Ghazali learned *Kalam*, philosophy and logic from his teacher 'Abd al-Juwayni or Imam al-Haramayn(d. 1085). Fakhry writes, "Al-Juwayni initiated his brilliant pupil [al-Ghazali] into the study of *Kalam*, philosophy, and logic". Majid Fakhry considered al-Ghazali as the most important figure in the history of Islamic reaction to Neo-Platonism and he is also a "jurist, theologian, philosopher, and mystic". In his other work on al-Ghazali, Watt says that al-Ghazali "has been acclaimed as the greatest Muslim after Muhammad, and is certainly one of the greatest".

Watt has admitted that there is a difficulty to write about al-Ghazali. "The difficulty is due to the great volume of his writings, to the fact that books were ascribed to him that were definitely not by him, and to the changes in his outlook which occurred during the course of his life". Probably due to al-Ghazali's vast and various knowledge, M. M. Sharif cannot place him in the theological-philosophical school, the mystical school or the philosophic-scientific school. Sharif has created another school named "middle-roaders" to place al-Ghazali and Fakhruddin al-Razi (d. 606/1209) in that school of thought. Sharif has divided Muslim philosophy during its first period of greatness from the first century A.H. or the seventh century A.C. to the fall of Baghdad into four distinctive schools namely the theological-philosophical, the mystical, the philosophical and scientific, and the middle-roader.¹³ Al-Ghazali is also included in the category of "political thinkers" in the work edited and introduced by M. M. Sharif.¹⁴

The main reference used here for his thought of mathematics, logic and philosophy is his *Ihya' 'ulum al-din* since it has been presented and portrayed as the most important work of al-Ghazali. Muhammad Lufti Jum'ah is of the opinion that *Ihya'* is the most famous work of al-Ghazali; it is a book of theology and ethics which is divided into four categories: the first is the religious symbols and rituals, the second, the particular regulations or rules

¹¹ W. Montgomery Watt, 1972, *Islamic Philosophy and Theology*, Edinburgh University Press, Edinburgh, p. 114.

¹² *Ibid.*, p. 115.

¹³ M. M. Sharif, 1963, "Introduction" in *A History of Muslim Philosophy*, Arayeh Culture, Tehran, p. 13.

¹⁴ *Ibid.*

related to the worldly and non-worldly lives, the third, the vices which can destroy human beings, and the fourth, the virtues which can save human beings.¹⁵ D. Collinson and R. Wilkinson consider *Ihya'* as "a lengthy synthesis" of al-Ghazali's views and he wrote it after he had composed his polemical writings against the philosophers.¹⁶ M. Campanini sees the importance of *Ihya'* in comparison with al-Ghazali's other works in term of the purpose of his composing *Ihya'*. The purpose is to reform or revive Allah's religion. Al-Ghazali became aware about the tradition, which says that Allah has promised to revive His religion at the beginning of each century. He was convinced that he was designated to carry out the duty to revive Allah's religion for his epoch. He then pursued "his reforming aim by composing a great work, whose title is significantly *The Revivification of the Sciences of Religion (Ihya' `ulum al-din),...*"¹⁷ Watt says that *Ihya'* is the greatest work of al-Ghazali and he writes, "it would not be out of place to note here that the title of his greatest book, *The Revival of the Religious Sciences*, presumes some decadence or decay in these sciences".¹⁸ Watt also describes *Ihya'* and its contents as follows, "His great work *The Revival of the Religious Sciences* contains a creed for memorizing and a short exposition of general Sunnite doctrines".¹⁹ For Prof. Dr. Osman Bakar, al-Ghazali's *Ihya'* is "one of the most extensive and influential works on Sufi ethics. It is the most visible fruit of al-Ghazaali's attempt to restore equilibrium and harmony between the exotic and esoteric dimensions of Islam".²⁰

C. Muslim philosophers' Thought of Mathematics, Logic, and Philosophy

The paramount importance of mathematics, logic and philosophy can be observed from the classification of sciences perceived by Muslim philosophers preceding al-Ghazali. They are al-Kandi (d.257/873), Al-Farabi or Alfarabi (d. 339/950) and Ibn Sina or Avicenna (d. 426/1037). For al-Kindi, philosophical sciences (*'ulum al-falsafah*) are three namely mathematics (*al-'ilm al-riyadi*), natural sciences (*'ilm al-tabi'iyat*) and metaphysics or theology. With regard to their nature and importance, the natural sciences occupy the lowest hierarchy since they deal with the sensible things (*al-mahsusat*). Theology or metaphysics is the highest since it does not deal with the sensible things. The intermediate position between those two sciences is mathematical sciences dealing with numbers, geometry, astronomy and formation.²¹

¹⁵ Muhammad Lutfi Jam'ah, *op.cit.*

¹⁶ Diane Collinson and Robert, *op.cit.*, p. 38.

¹⁷ Massimo Campanini, *op.cit.*, p. 264.

¹⁸ W. Montgomery Watt, 1971, *op Cit.*, p. 56-57.

¹⁹ *Ibid.*, 1972, p. 118.

²⁰ Osman Bakar, 1992, *Classification of Knowledge in Islam: A study in Islamic Philosophies of Science*, Institute for Policy Research, Kuala Lumpur, p. 171.

²¹ Mustafa Abd al-Raziq, 1944, *Tamhid litariikh al-falsafah al-istamiyyah*, Maktabah al-Thaqafah al-Diniyyah, al-Qahirah, p. 48.

Al-Farabi classifies sciences into five namely linguistic sciences, logic (*'ilm al-mantiq*), mathematical sciences, natural sciences and civilized sciences (*al-funun al-madaniyyah*).²² For al-Farabi, the importance of logic for providing the rules of correct thinking is comparable to the importance of grammar for providing the rules of correct sentences or expressions in every language. He writes that "the relationship of the art of logic to the intellect and the intelligibles is like the relation of the art of grammar to language and expressions. This is, to every rule for expressions, which the science of grammar provides us, there is a corresponding (rule) for intelligible, which the science of logic provides us".²³

Regarding the position of mathematics in the classification of sciences perceived by al-Farabi, Osman thinks that mathematics and political science "occupy a kind of intermediate position between metaphysics and natural science." Mathematics in al-Farabi's thought includes numbers and magnitudes consisting of lines, surfaces, solids, and the numbers and magnitudes are either abstract quantities which exist in human mind known as intelligible or concrete quantities which exist in material objects such as forms, shapes, colors, motions and sizes.²⁴

Ibn Sina places the importance of mathematics, philosophy and logic in his classification of sciences. He classifies sciences into four namely logic, natural sciences, metaphysics (*ma wara al-tabi'ah*), and mathematical sciences which occupy the intermediate position between the natural sciences and metaphysics.²⁵ Ibn Sina also classifies sciences into three namely the highest or loftiest science which has no connection or relation with the material thing (*al-maddah*) i.e. the First Philosophy (*al-hikmah al-'ula*) or metaphysics, the lowest sciences which have connection or relation with the material thing i.e. the natural sciences, and the intermediary sciences which come between the metaphysics and the natural sciences.²⁶ Ibn Sina defines the purpose of philosophy and divides it into theoretical and practical philosophies. As regards the purpose of philosophy, Ibn Sina says that it is "to be determination of the realities of all things, inasmuch as that is possible for a human being" Meanwhile the goal of theoretical philosophy "is to perfect the soul through knowledge alone. The purpose of practical philosophy is to perfect the soul through knowledge of what must be done, so that the soul acts in accordance with this knowledge".²⁷ Concerning the impor-

²² Muhammad Lutfi Jam'ah, *op.cit.*, p. 21.

²³ Deborah L. Black, "Al-Farabi" in *History of Islamic Philosophy*, Arayeh Culture, Tehran, p. 180.

²⁴ Osman Bakar, *op.cit.*, p. 100.

²⁵ Muhammad Lutfi Jam'ah, *op.cit.*, p. 55.

²⁶ *Ibid.*, p. 56-57.

²⁷ Shams Inati, "Ibn Sina" in *History of Islamic Philosophy*, Arayeh Cultural, Tehran, p. 233.

tance of logic in Ibn Sina's epistemology, he "considers logic as the key to philosophy, whose pursuit (knowledge) is the key to human happiness".²⁸

D. Al-Ghazali's Thought of Mathematics, Logic, and Philosophy

Watt holds the view that al-Ghazali classifies all sciences into two classes or categories namely Islamic sciences and philosophical sciences. This view of Watt is evident from what he writes, "What in effect al-Ghazali did was to examine the philosophical sciences to see how much of them was valuable as an addition to the Islamic sciences and how much had to be rejected. As a scholar-jurist he was interested in logical questions, since legal discussions sometimes involved these; and for years he was very enthusiastic about logic. His conclusions about the value of the philosophical sciences as given in *Deliverance from Error*, written about 1108, are the results of his mature reflection".²⁹ According to Watt, al-Ghazali "regards the philosophical sciences as six in numbers, namely, mathematics, logic, natural science, theology (or metaphysics), politics and ethics".³⁰

As regards the importance of mathematics in al-Ghazali's epistemology, Watt says that al-Ghazali holds that "Mathematics is entirely true... but the contemporary teaching of it (by philosophers) is attended by two drawbacks: the students of mathematics tend to think all the philosophers' arguments are as cogent as their mathematical ones, and ignorant opponents of mathematics from a religious standpoint bring religion in general into disrepute".³¹ According to Watt, in his book *The Aims of the Philosophers*, al-Ghazali stresses that "there is nothing in the conclusions of solid geometry and arithmetic which is contrary to religion." Watt understands from that statement of al-Ghazali is that "mathematical propositions are not contrary to rational theology".³² Regarding the role of logic in al-Ghazali's thought, Watt says that al-Ghazali holds that "Logic is likewise true and not contrary to religion in any way, but has the same two drawbacks as mathematics".³³

Marmura thinks that "Ghazali's attitude toward science and logic can be understood against the background of the occasionalism and atomism" which are endorsed and refined by the Ash`arite school since al-Ghazali is one of the Ash`arites. The occasionalism and atomism in the Ash`arite school make the school different from the Mu`tazilite school. The Ash`arites deny the concept of natural causation or causality. They adopt occasionalism to ex-

²⁸ *Ibid.*, p. 234.

²⁹ W. Montgomery Watt, 1971, *op.cit.* p. 66.

³⁰ *Ibid.*

³¹ *Ibid.*, p. 7.

³² *Ibid.*, p. 52.

³³ *Ibid.*, p. 67.

plain what happens in this universe that "action belongs only to a voluntary agent", and that "causal efficacy resides exclusively with the divine will." The Ash`arites adopt atomism to refute and deny "Aristotle's theory of the eternity and potential infinite divisibility of matter". For the Ash`arites, atoms and accidents are directly created and sustained by God. The created atoms and accidents form bodies and sustain them temporarily before they are annihilated by God. The Ash`arites adopt the theory of habit or custom to explain the nature's uniformity and regularity. The orderly universe has "no inherent necessity: it is simply a habit (*`ada*) or custom (*sunna*) arbitrarily decreed by the divine will. Consequently, disruptions of this uniformity, that is, miraculous happenings, are not impossible".³⁴ Marmura thinks that al-Ghazali opposes the philosophies of al-Farabi and Ibn Sina because their metaphysics is "necessitarian and emanative, deriving ultimately from Aristotle and Plotinus".³⁵

Al-Ghazali's classification of sciences is not limited to two classes or categories, Islamic and philosophical sciences although Watt says that al-Ghazali classifies sciences into those two classes. Al-Ghazali classifies sciences into many classes depending on their methods, purposes or sources. In his *Munqidh min al-dalal* (Deliverance from Error), al-Ghazali divides the knowledge seekers and their methods into four groups namely the Mutakallimun or the ulema of *Kalam*, Philosophers, Batinites and Sufis. Therefore, it is possible to assert that al-Ghazali classifies sciences into four types namely philosophy, the *Kalam*, esotericism and sufism based on the methods used by their seekers to attain their goals. Their goals are to attain the truth. However al-Ghazali prefers the sufi method to attain the truth for him.³⁶ Prof. Osman Bakar discusses al-Ghazali's *al-munqidh* and its "four classes of knowers" in great detail,³⁷ and Mustafa Abu-Sway also discusses al-Ghazali's *al-munqidh* in brief.³⁸

Based mainly on two works of al-Ghazali namely *Ihya'*, and *al-Risalat al-laduniyah*, and significantly referred to his two other works namely *The Jewels of the Qur'an* and the *Mizan al-'amal*, Prof. Dr. Osman writes that there are four different systems of classification of sciences used by al-Ghazali. The four systems are the practical and theoretical sciences, the presential and attained sciences, the religious and intellectual sciences, and the individual

³⁴ Michael E. Marmura, 1975, "Ghazali's Attitude to the Secular Sciences and Logic" in *Essays on Islamic Philosophy and Science*, State University of New York Press, Albany, p. 100.

³⁵ *Ibid.*, p. 101.

³⁶ Al-Ghazali, 1955, *Al-Munqidh min al-dalal*, Maktabah al-Injilu al-Misriyyah, Al-Qahirah. p. 27.

³⁷ *Ibid.*, p. 33.

³⁸ Osman Bakar. *op.cit.*, p. 182-197.

³⁹ Mustafa Abu-Sway. 1996. *Al-Ghazzali: A Study in Islamic Epistemology*. Dewan Bahasa dan Pustaka. Kuala Lumpur. p. 136-143.

and communal or collective obligatory sciences.³⁹ The fourth class refers to the Arabic terms, *'ilm fard 'ayn* and *'ilm fard kifayah*. The former means the sciences, which are obligatory upon every Muslim man and woman. The latter means the sciences, which are obligatory on particular Muslims only in any Muslim community. If there are some Muslims who learn and practice *'ilm fard kifayah*, it is considered sufficient, and other Muslims who do not learn and practice those sciences are not considered sinful.

In his *Ihya'* al-Ghazali does classify sciences based on their obligatoriness upon Muslims, and their worthiness and usefulness for Muslims and non-Muslims alike. He also bases his classification of sciences on their sources. Based on their obligatoriness either upon every Muslim or some Muslims, al-Ghazali divides sciences into two classes namely *fard 'ayn* and *fard kifayah*. Based on the worthiness and usefulness of sciences, al-Ghazali divides sciences into three, *al-'ulum al-mahmudah* (the praiseworthy, commendable or laudable sciences), *al-'ulum al-madhmunah* (the dispraiseworthy or blame-worthy sciences), and *al-'ulum al-mubahah* (the permissible or allowable sciences). With reference to the sources or origins of sciences, al-Ghazali classifies them into *shar'iyah* and *ghayr shar'iyah* (the religious and non-religious sciences). The religious sciences are derived from the prophets peace be upon them. These sciences are not originated from human reason, experience or audition. Al-Ghazali writes that the science originated from human reason is like mathematics (*al-hisab*), and from human experience is like medicine (*al-tibb*) and from human audition is like linguistics (*al-lughah*). Al-Ghazali divides the non-religious sciences into the praiseworthy, blame-worthy and permissible sciences. The praiseworthy non-religious sciences are those related with the improvement or betterment of worldly affairs (*masalih umur al-dunya*) such as medicine and mathematics. Al-Ghazali also classifies the praiseworthy non-religious sciences into *fardu kifayah* and *fadilah*. Medicine and mathematics are among the praiseworthy communal obligatory non-religious sciences. Medicine is necessary (*daruriyy*) to maintain and sustain bodies (*baqa' al-abdan*), and mathematics is necessary in transactions, dividing wills and inheritances and etc. The praiseworthy communal obligatory non-religious sciences are necessary for supporting or mainstaying worldly affairs. If a country does not have those who are knowledgeable and learned in those sciences, its inhabitants are in trouble. If some of the inhabitants are knowledgeable in those sciences, it is not obligatory anymore on the other inhabitants. Therefore, mathematics and medicines are among the praiseworthy communal obligatory non-religious sciences like *al-falahah* (agriculturing), *al-hiyakah* (weaving or knitting), *al-siyasah* (politics) and *al-*

³⁹ Osman Bakar, *loc.cit.*, p. 203.

khiyatah (sewing, or tailoring). Although mathematics is included among the praiseworthy communal obligatory non-religious sciences, al-Ghazali also considers it as a *fadilah* upon Muslims to learn mathematics in detail or to learn it beyond what is necessary.⁴⁰

Al-Ghazali's thought of logic and philosophy is not as positive as mathematics. He was asked the reason for not including the *Kalam* and philosophy in his classification of sciences (*aqşam al-'ulum*) and also for not explaining both sciences either they are among the praiseworthy or blameworthy sciences. According to al-Ghazali, philosophy is not a science by itself. In other words, philosophy is not an independent science. He thinks that philosophy consists of four components or divisions (*ajza'*). One of the four components is geometry and mathematics (*al-handathah wa al-hisab*). Both sciences are permissible. However, there are some people who prohibit geometry and mathematics if both sciences lead to the blameworthy sciences; many experts in geometry and mathematics go to *al-bid'a* (the religious innovation or heresy) and therefore those who are weak in both sciences should be protected. The protection is not due to both sciences themselves. It is analogous with the protection of a child from a riverbank for fearing him falling into the river or the protection of a new Muslim during the early days of Islam from mixing with the non-Muslims for fearing their influence over him.⁴¹

The second component of philosophy is logic (*al-mantiq*); it is a study related to proof or evidence and its conditions and to definition and its conditions. Both evidence and its conditions as well as definition and its conditions are inclusive in the *Kalam*.⁴² The subjects of logic in al-Ghazali's thought are two; they are evidence and definition and their conditions. Meanwhile, logic in the eyes of al-Farabi has eight subjects; they include the rules about intelligible or ideas, the rules about simple statements or propositions, the rules of syllogisms, the rules of demonstrative and philosophical proofs, the rules of dialectical proofs, the deception and misleading rules, rhetoric and poetry.⁴³

The third component of philosophy in al-Ghazali's thought is metaphysics (*al-ilahiyyat*). It studies Allah's essence and attributes; it is also inclusive in the *Kalam*. Philosophers (*al-falasifah*) are not limited to one particular school of philosophy. They are divided into many schools of philosophy. Some of their schools are *kufr* (unbelief, disbelief, infidelity, atheism, irreligion) and some others are *bid'ah* (heresy, heterodoxy, unorthodoxy).⁴⁴ It is evident

⁴⁰ Al-Ghazali, *op.cit.*

⁴¹ *Ibid.*, p. 33.

⁴² *Ibid.*

⁴³ Osman Bakar, *op.cit.*, p. 121-122.

⁴⁴ Al-Ghazali. *op.cit.*, p. 34.

here that al-Ghazali does not see any positive contribution made by philosophy when it deals with metaphysics. For him, metaphysics is limited to studying about Allah's essence and attributes. This component of philosophy is either atheistic or heretical. Metaphysics in the thought of al-Farabi is broader than that in al-Ghazali's. Al-Farabi says that metaphysics deals with beings and their essential attributes, the principles of demonstration in theoretical sciences, and absolute incorporeal beings.⁴⁵

The fourth component of philosophy in al-Ghazali's thought is *al-tabi'iyyat* (physical or natural sciences). Some of the natural sciences are contrary to the Islamic law, the religion of Islam and the truth (*mukhalif lil-shar'i wa-al-din wa-al-haqq*). They are ignorant, not sciences which can be included in the division or classification of sciences. Some of the natural sciences study the attributes of bodies, their particularities and how they are changed and transformed; these are similar with the studies done by medical doctors. However, a medical doctor studies human body in particular his illness.

E. Epilogue

Al-Ghazali's thought of logic and philosophy is not as positive as mathematics. He did not include the *Kalam* and philosophy in his classification of sciences and did not explain both sciences either they are among the praiseworthy or blameworthy sciences. Philosophy is not science itself. In other words, philosophy is not independent science.

REFERENCES

- Abu-Sway, Mustafa. 1996. *Al-Ghazzaliy: A Study in Islamic Epistemology*. Dewan Bahasa dan Pustaka. Kuala Lumpur.
- Al-Ghazali. 1955. *Al-Munqidh min al-dalal*. Maktabah al-Injilu al-Misriyyah. Al-Qahirah.
- Al-Sayuti, Jalal al-Din. 1948. *Sawn al-mantiq wa al-kalam 'an fann al-matiq wa al-kalam*. Dar al-Kutub al-'Ilmiyyah. Bayrut
- Al-Raziq, Mustafa Abd. 1944. *Tamhid litarikh al-falsafah al-islamiyyah*. Maktabah al-Thaqafah al-Diniyyah. al-Qahirah.
- Azizah, Nor. 1995. "Strategies to implement critical thinking in adult and teacher-education" dalam *Prosiding Konvensyen Antara Bangsa*

⁴⁵ Osman Bakar, *loc.cit.*, p. 123.

Kecemerlangan Berfikir. Fakulti Pendidikan Universiti Kebangsaan Malaysia. Bangi.

- Bakar, Ibrahim Abu. 2001. *Ilmu Kalam Paucis Verbis (Secara Ringkas)*. Krisma Publications. Shah Alam.
- Bakar, Osman. 1992. *Classification of Knowledge in Islam: A study in Islamic Philosophies of Science*. Institute for Policy Research. Kuala Lumpur.
- Black, Deborah L. "Al-Farabi" in *History of Islamic Philosophy*. Arayeh Culture. Tehran.
- Collinson, Diane and Robert Wilkinson. 2000. *Thirty-Five Oriental Philosophers*. Routledge. London.
- Companini, Massimo. "Al-Ghazali" in *History of Islamic Philosophy*, Arayeh Cultural. Tehran.
- Inatí, Shams. "Ibn Sina" in *History of Islamic Philosophy*. Arayeh Cultural. Tehran.
- Jam'ah, Muhammad Lutfi. *Tarikh falasifah al-islam fi al-mashriq wa al-maghrib*. al-Maktabah al-'Ilmiyyah. S.l.
- Kuhn, Deanna. 1988. "Introduction" in *The Developmet of Scientitic Thinking Skills*. Academic Press. San Diego California.
- Marmura, Michael E. 1975. "Ghazali's Attitude to the Secular Sciences and Logic" in *Essays on Islamic Philosophy and Science*. State University of New York Press. Albany.
- Sharif, M. M. 1963. "Introduction" in *A History of Muslim Philosophy*. Arayeh Culture. Tehran.
- Sheikh, M. Saeed. 1963. "Al-Ghazali : Metaphysics" in *A History of Muslim Philosophy*. Otto Harrassowitz. Wiesbaden.
- Warnick, Barbara and Edward S. 1994. *Critical Thinking and Communication: The Use of Reason in Argument*. Macmillan Publishing Company. New York.
- Watt, W. Montgomery. 1971-1972. *Islamic Philosophy and Theology*. Edinburgh University Press. Edinburgh.
- Wolfson, Harry Austryn. 1979. *Studies in the History of Philosophy and Religion*. Harvard University Press. Cambridge.
-