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**Stolberg's Typology of Religioscientific Frameworks
and Science and Religion
Education In Ghana**

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Abstract

This research took cue from Stolberg's work on the typology of religioscientific frameworks in the teaching and learning of science and religion to examine the importance of the intense religious orientation of Ghanaians for developing science education curriculum for Ghanaian institutions of learning. Using group interview and qualitative survey, the study investigated the beliefs and preferred strategies for life used by students of the University of Cape Coast. It was found that participants were not unaware of scientific convictions and solutions, but their beliefs and strategies tended more towards the cultural religious construction of life, where religion would seem to constitute an important source of knowledge with science playing only a pragmatic role. The study concluded that it was important for science education curriculum developers to consider the religious frameworks of teachers and learners when designing science education curriculum.

Introduction

Ghana is not alone in the race to harvest the benefits of modern science and technology for the development and poverty alleviation of its citizens. Governments and non-governmental

organizations have been making diverse interventions to boost the morale of science students. For example, from about the mid-1990s, the Government of Ghana and the World Bank carried out the science resource project in Ghana, creating science centres in Senior High Schools (SHS) in all civil districts, and introducing new science courses and training programs for science teachers. Since then, similar interventions have been made with the hope to motivate many more students to choose to learn science. These include programmes such as teaching science and mathematics, and conducting inter-school science and maths-quiz competitions on national TV and Radio (with prizes).¹

Most of these activities received support and approval from the Ministry of Education and were funded partly by the Ghana Education Trust Fund (GETFUND). One could single out particularly the efforts to motivate female students to take to studying science and mathematics by promoting the image of female Ghanaian scientists and awarding outstanding female science teachers. Two important personalities who received positive profiling as female models of science and industry were the industrialist, Esther AfuaOcloo [Nkulenu] (1919 - 2002) and the biochemist, Marian Ewurama Addy (1941 - 2014). The former was one of the first women industrialists, who founded and managed the Nkulenu Food Processing Industry and cofounded the Women's World Banking (WWB), a global micro-lending organization. The latter participated in various national and international attempts to revamp science education in Ghana. Among these were the United Nations Development Programme (UNDP, 1994) consultancy for formulating a national action programme for science and technology development in Ghana. The urgency with which Ghana seeks scientific and competency based education cannot be overemphasized when these initiatives are set within the numerous education reforms aimed at the attainment of the same goals. Despite these initiatives to boost science education, there is both anecdotal and documented evidence from research² to the effect that there is a relatively slow improvement in performance in the learning of science and mathematics at different levels of education in Ghana.

¹Anamuah-Mensah, J. (1999). *Science and Technology Education in Ghana*. A paper delivered at the National Education Forum on the theme: Towards Sustaining an Effective National Education System, held at the Accra International Conference Centre, Accra, 17-19th November.

²Minister of Education, High failure rate in science and mathematics must stop. *Ghana New Agency*, 15th February 2017.

Problem Statement

Several reasons account for the gap between present performance in the teaching and learning of science and national expectations. Some of the reasons that have received attention in research include the quality of science teacher education, lack of teaching and learning resources, poor pedagogical tools and environmental factors. However, little attention has been given to the philosophical foundations of science education in Ghana, such as the complex relationships between the empirical/secular orientation of science education and the strong suggestions about the general “religious orientation” of the Ghanaian population. As such, attempts to motivate science-education take place in an evidently religious environment of which the curriculum is by and large oblivious. In this research, the central issue is to examine the importance of the intense religious orientation of Ghanaians in developing science education curriculum for Ghanaian institutions of learning.

Objectives

Essentially, the research seeks to build on Stolberg’s³ study to make a claim for including the element of Ghanaian religiosity in any needs assessment phase of curriculum development for science education at all levels of education in Ghana. The paper also aims at initiating a discussion on the relevance of religioscientific conceptual frameworks for designing culturally relevant pedagogies for science (and religion) education in Ghana.

Review of Stolberg’s Typology

Stolberg, citing Cobern, Smith, and Ayala,⁴ set out to complement efforts of research (in the United States) on the relation between religious belief and the acceptance of scientific concepts by focusing on how different religioscientific frameworks of students and

³ T. L. Stolberg, Student thinking when studying science-and-religion. In *Zygot*, 44(4), (2009), 847-858.

⁴ W. W. Cobern, *Everyday thoughts about nature*. (Dordrecht: Kluwer Academic, 2000a); W. W. Cobern, Point: Belief, understanding, and the teaching of evolution. In *Journal of Research in Science Teaching*, 31, (1994) 583-590; M. U. Smith, Counterpoint: Belief, Understanding and the Teaching of Evolution. In *Journal of Research in Science Teaching*, 31, (1994), 591-597; F. J. Ayala, Arguing for Evolution: Holding strong religious beliefs does not preclude intelligent scientific thinking. *Science Teacher*, 62(2), (2000), 30-32.

teachers relate to their attitudes when learning science, and their significance for developing a suitable pedagogy for science-and-religion education.⁵ He published his research under the title "Student thinking when studying science-and-religion." Science-and-religion is an area of study, particularly in philosophy of religion, which is currently achieving much multidisciplinary attention. Stolberg built his work on findings of Roth and Todd⁶ and Cobern,⁷ who believe that understanding religioscientific patterns of thought can help to clarify how a particular frame of reference can affect thinking of an individual. In addition, and based on a previous study that reviewed the teaching and learning of science-and-religion in tertiary institutions in the United Kingdom, Fulljames and Stolberg⁸ were able to conclude that whereas many students chose dialogue between science and religion (in consonance with what course designers preferred), it was not the only "intellectual pattern." There were other preferences, including "instances of the notion of conflict", and especially, "different students use different ways of accommodating scientific and religious ways of thinking for different issues."⁹ In an earlier research, Stolberg would also find that teachers did not differ from students in terms of how their religioscientific frameworks affected their thinking about both disciplines and life generally.¹⁰ A teacher's religious or scientific conceptual scheme determined whether the teacher would consider science and/or religion as source of knowledge (epistemic dimension) or as a functional tool (pragmatic dimension) for negotiating life.

Based on his research findings, Stolberg¹¹ concluded that it was possible to categorize the different frames of reference pertaining to science and religion into four types, which when drawn on a mutually perpendicular two-dimensional scale would be represented by four quadrants (epistemic religion; pragmatic religion; epistemic science; pragmatic science). An individual's religioscientific framework could then be conveniently plotted as a point in any one of the quadrants on the two-dimensional scale.

⁵Stolberg, 2009, 848, Endnote 1.

⁶W-M.Roth & A. Todd, The interaction of students' scientific and religious discourses: Two case studies. *International Journal of Science Education*, 29, (1997), 25-146.

⁷Cobern, 2000a.

⁸ P. Fulljames & T. L. Stolberg, Consonance, assimilation or correlation? Science and Religion courses in higher education. *Science and Christian Belief*, 12, (2000), 35-46.

⁹Stolberg, 2009, 849.

¹⁰ T. L. Stolberg, The religio-scientific frameworks of pre-service teachers: An analysis of their influence on their teaching of science. In *International Journal of Science Education*, 29, (2007), 909-930.

¹¹Stolberg, 2009, 850.

Stolberg explains that if a person would be positioned at a point in the quadrant of epistemic religion and pragmatic science, then that person would possess a conceptual framework in which science and religion are experienced as separate realities. Religion would constitute the default source of knowledge for that person, and it would control not only their thinking about science, but also their morals and values, and life in general. Science would be important for such a person only technically, and in as far as it provides solutions to problems. On the contrary, an individual positioned on a point in the epistemic religion and epistemic science quadrant is more likely to have a framework that aspires for integration of religion and science as sources of knowledge, of equal importance in helping to acquire deeper understanding of the physical and material world, as well as serving together or separately as valid domains of metaphysical and “potentially life-changing or life-enhancing” experiences.¹²

The third and fourth of Stolberg’s quadrants would plot individuals for whom “science and religious knowledge and understanding” have little relevance for their personal lives¹³, and those who would see science as the source for knowledge, deserving every attention as the basis for making “informed life-choices, no matter their religious or cultural heritage”¹⁴ respectively.

Stolberg did not set out to study the relevance of a culturally diverse approach to the teaching and learning of science and religion. Yet, I suppose that his findings do in some ways point in that direction. This supposition stems from his argument that an individual’s conception about the epistemic and pragmatic importance of religion on the one hand, and science on the other hand, is capable of influencing an individual’s attitude towards learning and teaching of science. Since some cultures or sub-cultures tend to be more religious than others, attempts to design curricula by paying attention to the religious framework of learners and teachers must have cultural significance.

Methodology

This study takes its motivation and focus from Stolberg’s ideas, but it does not aim at replicating his research. Stolberg conducted his study of the religioscientific frameworks of students in relation to learning of science-and-religion as a subject of its own right in higher education; this study is looking at frameworks in relation to

¹²Ibid, 851.

¹³Ibid, 2009, 851.

¹⁴Ibid, 2009, 851.

the teaching and learning of science and religion as separate disciplines, and the approach here is different from Stolberg's.

Based on qualitative research approach,¹⁵ group interview and survey were used to collect data on how participants perceive and experience religion and science as sources of their beliefs, ideas, and practices. Though survey is popular in quantitative research, in recent times, scholars¹⁶ have also proposed a qualitative survey approach.

One of the earliest hints of the qualitative survey was given by Fink,¹⁷ who discussed the "analysis of qualitative surveys". Before Fink's use of the term "qualitative survey", existing literature¹⁸ generally associated surveys with the sociological concept for "constructing quantitative descriptors of the attributes of the larger population of which the entities are members."

Qualitative survey distinguishes itself from quantitative survey by way of purpose and intent. Jansen explains the characteristic difference of qualitative survey in this way:

The qualitative type of survey does not aim at establishing frequencies, means or other parameters but at determining the *diversity*[author's italics] of some topic of interest within a given population. This type of survey does not count the number of people with the same characteristic (value of variable) but it establishes the meaningful variation (relevant dimensions and values) within that population.¹⁹

The way to understand Jansen is that qualitative survey is more interested in the diversity of participants' perception and experience of a given phenomenon than accounting numerically for the distribution of the occurrence of the phenomenon in varying quantities across individual members of a population.

¹⁵J. Mason, *Qualitative researching*. (London: Sage, 2002).

¹⁶A. Fink, *The survey handbook*. (Thousand Oaks, CA: Sage, 2003); H. Jansen, The logic of qualitative survey research and its position in the field of social research methods. In *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research*, 11(2), (2010). Available at <http://nbn-resolving.de/urn:nbn:de:0114-fqs10021102010>

¹⁷Fink, *The survey handbook*, 2003.

¹⁸ R. M. Groves, F. J. Fowler, M. P. Couper, J. M. Lepkowski, E. Singer & R. Tourangeau, *Survey Methodology* (Hoboken, NJ: John Wiley & Sons, 2004), paragraph 2; Jansen, 2010, Article 11.

¹⁹Jansen, 2010, Article 6.

During the group interviews, participants discussed aspects of life in which they make decisions or seek solutions by adopting what may be loosely called scientific and/or religious perspectives. Many of them admitted that cultural expectations made having one's own children important. They saw reproductive health challenges (and maintaining good health generally) as an important test of the average Ghanaian's beliefs (epistemology) and approach (pragmatism) to life. The group also identified issues of belongingness through relationships of marriage, family, and friendship to be equally important. The third area in which participants of the group interview thought people were most likely to express their beliefs and approach to life concerned security – self-preservation and “abundant life.”²⁰ The factors that could cause harm to life were perceived to include witchcraft, tragedies, and accidents that people attribute to mystical forces. Other domains that the group identified were the need for general success in life (wealth and wellbeing) in the various manifestations of self-transformation.

From the data generated through the group interviews, ten (10) important themes for identifying the religio-scientific frameworks of students were selected. The themes included reproductive health, mental health, general success (or fulfilled life), causes of tragedies, love and friendship, mystical beliefs, sources of basic necessities (e.g. potable water) and causes of death. From these themes, a questionnaire using forced-choice questions based on a five-point ordinal scale²¹ was designed as a social survey data collection instrument. The scale was expected to measure the extent of agreement of participants to the list of statements concerning the roles of religious belief or science in the different situations of life represented by the themes. Participants were to indicate whether they strongly agreed, agreed, disagreed, strongly disagreed or were not sure (what to say).

The questionnaire had ten (10) sections lettered A – J. Each section had four propositions to which participants were to express their level of agreement or disagreement. For example, regarding the theme of reproductive health, the statement in section A1 proposed: “If my partner and I want our own biological child, it would be alright to visit a medicine man/woman.” The follow-up question A2 proposed, “If my partner and I ... it would be alright to visit a (Christian) pastor.” A3 proposed visiting a “charismatic

²⁰ L. Magesa, *African religion: The moral tradition of abundant life* (Maryknoll: Orbis, 1997), ix.

²¹ A. Bryman, *Social research methods*. (3rd ed.). (Oxford: Oxford University Press, 2008).

healer”, and A4 suggested visiting “a medic”. Only section J had five statements about the theme of death (in order to capture religious perspectives more broadly). Essentially, the choice was between a religious and a natural scientific perspective. The alternatives or follow-up questions for each theme were to provide a plural view of “religion”, with mostly one clear scientific option.

The study purposively sampled the Faculties of Arts, Social Science, Natural Sciences, Institute of Education, and the School of Medical Sciences as units of the University of Cape Coast. Using the enrolment list from these units, two hundred students were randomly selected as participants. Out of the 200 questionnaires served, 149 of them were answered and returned, yielding about 75% response rate. Research assistants of the Department of Religion and Human Values helped with the distribution and retrieval of questionnaires. Data was processed using the 2010 version of GrafStat,²² a free online survey program designed for the use of the German Federal Department for Civic Education and Social Research by Uwe Diener. Data analysis was limited to descriptive statistics, and tables were generated from the statistics to illustrate results.

Presentation and Analysis of Data

Table 1

Respondents’ religious and/or scientific approaches to selected aspects of life

Frequency and percentage of responses respectively

Question	Strongly Agree	Agree	Disagree	Strongly Disagree	Not Sure	Without Answer
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Theme A: It is okay to solve reproductive problems through:

A1: a medicine man or woman	16 11.27%	30 21.13%	28 19.72%	68 47.89%	0 0.0%	7
A2: a pastor	38 26.57%	56 39.16%	30 20.98%	19 13.29%	0 0.0%	6

²² U. Diener, GrafStat (2010). Available at <http://www.grafstat.eu/eng>

A3: a charismatic healer	18 12.77%	36 25.53%	47 33.33%	40 28.37%	0 0.0%	8
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A4: a medic	57 40.71%	51 36.43%	17 12.14%	15 10.71%	0 0.0%	9
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Theme E: Roof wrecks are caused by:

E1: bad technology	103 70.0%	36 24.49%	5 3.40%	3 2.04%	0 0.0%	2
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E2: mysterious circumstances	9 6.47%	21 15.11%	49 35.25%	60 43.17%	0 0.0%	10
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E3: bad luck	5 3.60%	10 7.19%	46 33.09%	78 56.12%	0 0.0%	10
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E4: spiritual enemies	5 3.60%	9 6.47%	47 33.81%	78 56.12%	0 0.0%	10
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Theme F: Choice of lover is explainable from:

F1: human nature	65 44.83%	64 44.13%	11 7.59%	5 3.45%	0 0.0%	4
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F2: psychology	31 22.14%	77 55.00%	23 16.43%	9 6.43%	0 0.0%	9
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F3: will of God	60 42.55%	58 41.13%	14 9.93%	9 6.38%	0 0.0%	8
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F4: religious beliefs	22 15.71%	59 42.14%	27 19.29%	32 22.86%	0 0.0%	9
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Theme I: Untimely death is usually:

I1: due to sin	22 16.06%	52 37.96%	34 24.82%	29 21.97%	0 0.0%	12
I2: the will of God	49 35.00%	55 39.29%	22 15.71%	14 10.00%	0 0.0%	9
I3: due to witchcraft	35 25.00%	53 37.86%	24 17.14%	28 20.00%	0 0.0%	9
I4: from envious person	26 18.57%	64 45.71%	32 22.86%	18 12.86%	0 0.0%	9
I5: due to natural causes	44 31.43%	62 44.29%	24 17.14%	10 7.14%	0 0.0%	9

Table 1 presents data from the four important themes of reproductive health, accidents, love and friendship, and death. The data for the theme on reproductive health produced an unexpected result. Only 16 respondents strongly agree that it would be acceptable for them to approach a (traditional) medicine man or woman for help if they were facing challenges in having their own biological child. An overwhelming 68 respondents strongly disagreed with the medicine man or woman approach. One would have expected that 68 or more respondents would strongly agree with the option of using a medic to solve their reproductive health challenges. But only 57 respondents strongly agreed to the use of a medic. The picture gets clearer, however, when one notices that the medicine man/woman option represents the Traditional Religious option and that in responding to type of religious affiliation, zero (0) respondents chose African Traditional Religion (Table 2). In contrast, 135 respondents identified themselves as Christians. It is not surprising then that in responding to the same question about reproductive health, the number that strongly agreed with the Christian pastor approach increased to 38, with another 56 agreeing and only 19 strongly disagreeing with the option. The responses for the traditional religious option for solving reproductive health challenges may therefore have been affected by the social desirability bias or they may be an indication of the shift in respondents' religious identity.

Table 2
Religious Affiliation

Affiliation	Number of Respondents
Christian	135
Muslim	11
Traditionalist	0
Others	1
No answer	2
Total	149

Using the Christian religious option then receives almost equal acceptance, as does the medical option. Data collected from the group interview further indicated that when people were faced with serious challenges for which they found no solutions from scientific approaches, they ultimately turned to religious beliefs for explanation and solution. Combining this piece of information from the interview with data from the questionnaire point in one direction. It is the impression that respondents most likely consider science as hardware, in the form of technology, to be harnessed for the preservation and improvement of life.

Commensurate with this inference is the fact that respondents tended to choose the scientific option with a much higher percentage when the question dealt with the role of technology in providing the necessities of life. For example, under the theme of tragedy and accidents, an overwhelming 103 respondents constituting 70% of the responses to the question strongly agreed that “bad technology” caused roof wrecks (see Table 1). Another 24.49% agreed, yielding a total of 94.49% agreeing that bad technology was the cause of roof wrecks. Consistently, only 3.60% strongly agreed that spiritual enemies were the cause of roof wrecks. Similarly, respondents had a pragmatic science approach to basic necessities of life such as good drinking water, given that 65.19% strongly agreed that they would consider water free of bacteria as good water. This contrasts greatly

with the mere 5.80% that strongly agreed that good water came from a sacred river.

Going back to other issues that engaged respondents more on an epistemic rather than a pragmatic level, one finds an increase in the number of responses preferring the religious approach. For example, 42.55% of responses strongly agreed, and another 41.13% agreed that the choice of a lover was explainable by the will of God. It is remarkable that only 22.14% of the responses strongly agreed, though another 55.00% agreed that psychology explained the choice of one's lover (Table 1).

Equally remarkable are the data obtained regarding the theme of death. During the group interview, participants were unanimous in holding the view that life was very important for many Ghanaians. Participants discussed the themes of reproduction (birth) and end-of-life (death) issues with much passion. They concluded that in an average Ghanaian community, sudden death of a young person was most likely to have religious interpretations, such as attribution to witchcraft or the will of God, and only partial acceptance of a coroner's report.

Data generated from the survey showed that 49% of responses strongly agreed that sudden death was the will of God, while 44% strongly agreed that sudden death was attributable to natural causes (see Table 1). How significant is the 5% difference in favour of a religious epistemology of death? Obviously, this research does not have the tools to make such a judgement, because it presupposes a quantitative analysis. From the qualitative perspective however, it can be explained that the 5% more responses attributing sudden death to religious belief than to natural causes express a meaningfully variant perception and experience of participants.

Findings and Discussion

Findings worth considering from the study include the fact that religion plays a role in the mental frame of students generally. At least, the data provide some indications of students of UCC, Cape Coast, who share in the cultural religious construction of life, where religion would seem to constitute an important source of knowledge. As Stolberg concluded from his study, such religious conceptual framework tends to control how people think about science and life in general. Here science is valuable in as much as it solves problems, but it is kept separated from religious knowledge, and is not harnessed to join with religion to provide a foundation for the life of the individual or the community. Stolberg located this

approach in the epistemic religion and pragmatic science quadrant of his typology²³.

Van Dyk has noticed this tendency for people in Africa to consider natural scientific factors as accounting for only the “immediate cause” and not the “ultimate or personal cause” of problems.²⁴ Several other studies by Hammond-Tooke, Herselman, and Mbiti,²⁵ which van Dyk also cites support this view. For example, in the context of HIV and AIDs, van Dyk points out that many African patients believe that there must be a personal/ultimate cause for infection. They ask why two men will have sex with the same woman and only one of them becomes infected with the virus. Van Dyk suggests that in such a situation, “the only answer that will really satisfy [the patient] is that someone, by means of magical manipulation, has “caused” or “sent” the germ to make her sick instead of her neighbour (the personal or ultimate cause of the illness).”²⁶ Elsewhere, this belief in the spiritual cause of illness has been described as a “personalistic aetiology of disease.”²⁷

The renowned Ghanaian philosopher, Wiredu,²⁸ does not hide his misgivings about this tendency for many African people to adopt a religious epistemic approach to life’s problems, which he believes are better resolved scientifically in the modern world. Wiredu bemoans this “traditional” epistemic disposition, compares its limitations to what he considers to be the overarching advantages of science and describes the epistemic religious framework as “supernaturalism”. Wiredu’s scientific positivism is not without criticism, but as an insider of Ghanaian culture, he clearly points to and criticizes the epistemological force of religion in the day-to-day activities of the average Ghanaian. In short, it is important for the Ghanaian educationist to interrogate the suggestion that when religion constitutes the default source of

²³Stolberg, 2009, 852.

²⁴ A. C. Van Dyke and C. Alta, Traditional African beliefs and customs: Implications for AIDS education and prevention in Africa. In *South African Journal of Psychology*, 31(2), (2001), 60-66.

²⁵ D. Hammond-Tooke, *Rituals and medicines*. (Johannesburg: AD. Donker, 1989); S. Herselman, A multicultural perspective on health care. In M. Bouwer, M. Dreyer, S. Herselman, M. Lock, & S. Zeelie (Eds.) *Contemporary trends in community nursing*.(Johannesburg: Thomson, 1997); Mbiti, *African religions and philosophy* (Nairobi: Heinemann Publishers, 1969), 169.

²⁶ Van Dyke, 2001, 5.

²⁷G. Foster, Disease Etiologies in Non-Western Medical Systems. *American Anthropologist*, Vol. 78, (1976), 773-782.

²⁸ K. Wiredu, *Philosophy and an African Culture*, (Cambridge: Cambridge University, 1980), 37-50.

knowledge for a person, science is considered as a finished product only.

On the contrary, an individual positioned on a point in the epistemic religion and epistemic science quadrant is more likely to have a framework that aspires for integration of religion and science as sources of knowledge, of equal importance in helping to acquire deeper understanding of the physical and material world, as well as serving together or separately as valid domains of metaphysical and “potentially life-changing or life-enhancing” experiences.²⁹

To attain the goals of scientific and technological advancement that Ghana so earnestly desires, science curriculum developers may want to consider the opportunities available for bringing science and religion together in a balanced learning experience.³⁰ Contemporary studies support the conception that both religion and science become real through specific cultural embodiment.³¹ Used as a description of the diverse ways of living found among different groups of people, culture has had a significant journey of favourable and unfavourable anthropological interpretations and socio-political associations. However, modern cultural theory has more potential for proposing that modern science can develop under multiple cultural contexts while maintaining its basic characteristics.

“Traditional” Africa must have had a confirmation rather than conflict paradigm of science and religion relations before the advent of modern science. “Technological/scientific” talents were ritualized. Blacksmithing, for example, was a “mystical” industry in sub-Saharan Africa.³² This culturally conjoined experience of science and religion is not unique to Africa, since “science emerges in the context of humanity’s innate quest for survival within a specific environmental, ecological, and social context.”³³ However, the anti-religious tendencies of the modern period in which

²⁹Stolberg, 2009, 851. See also Tsala’s view about disease causation in Africa where “every disease is systematically acknowledged as having a supernatural origin - the grief of ancestors or divinities, the practice of sorcery and various evil spells. To an African, biology alone does not explain disease causation” (http://www.inst.at/trans/15Nr/02_7/idemudia15.htm).

³⁰See S. Awuah-Nyamekye, The role of religion in indigenous healthcare practices in Ghana’s development: Implications for Ghanaian universities, *Journal of Theology for Southern Africa* 138 (November 2010, pp. 36-56).

³¹P. Hefner, Editorials: Culture is where it happens. In *Zygon* (2005), 523-527.

³²G. Emeagwali, Science and religion in Africa. In A. Esien & G. Laderman, Science, religion, and society: An encyclopedia of history, culture, and controversy, Volume 1, (New York: M. E. Sharpe, 2007), 42-47; N. J. van der Merwe & D. H. Avery, Pathways to steel. In *American Scientist*, 70, (1982) 146-55.

³³Emeagwali, 2007, 42; citing Feyerabend, 1924-94 and Popper, 1902-94.

modern science developed and its mediation and dissemination through western culture has had peculiar implications.

In Africa, for example, African traditional thought is frequently pitched against modern science.³⁴ The latter is cognitive rationality, the former magic. In many regards, the dichotomy that has shaped the history of modern science transformed into an inter-cultural differentiation in the wake of African-Western relations. Horton observes, therefore, that despite the confirmation model of science and religion relations that must have existed in Africa, little success has been made in maintaining and developing this unity of the sciences with the introduction of modern science.³⁵ It is unfortunate that despite this observation, Horton, being a child of his culture and day, got trapped in the anachronistic fallacy of comparing Western science and African traditional thought, giving the impression that what is typically African is the traditional.³⁶ Unlike Harris, however, Horton makes a strong case when he stresses, "human cognitive rationality is common to the cultures of all places on earth and all times since the dawn of properly human life."³⁷ Human beings will, in their various ways and according to their varied cultural strategies apply "cognitive rationality" in the bid to humanize their existence.

Nevertheless, the concept of contextualized science usually has a paradox to solve. For, besides its secularizing tendencies, modern science thrives on standardized methods of observation, experimentation and measurement. These are needed for understanding the laws of nature. Standardization may not mean homogeneity, but standards set boundaries and orient thought and action in a generally recognizable construct across diverse contexts. In effect, science and technology become important variables for the construction and comprehension of social reality, since they tend to organize thought and social interaction using standardized means for achieving set goals.³⁸ Some would argue, therefore, that it constitutes a contradiction in terms to prefix cultural or contextual diversity to modern science, say, African-science or European-science.³⁹ Curriculum planners may not be the ones to solve this dilemma, but they must consider how specific frameworks of the Ghanaian culture influence the teaching and

³⁴Horton, *Patterns of thought in Africa and the West: Essays on magic, religion and science*. (Cambridge: Cambridge University Press, 1993).

³⁵Horton, 342.

³⁶Ibid, 340.

³⁷Ibid, 342.

³⁸ J. Ellul, *Technology: The surrender of culture to technology* (New York: Vintage Books 1993).

³⁹Wiredu, 1980, 1-25.

learning of science and aspire towards pedagogies of the confirmation models of science and religion relations.⁴⁰

Conclusion and Recommendations

Stolberg's study has important significance for our discussion on the possibility of a culturally diverse approach to the learning and teaching of science and religion in Ghana. First the idea of breaking down the intangible but practical reality of conceptual frameworks to recognizable units by the use of models is itself of great scientific value. Models "help to structure the motives underlying specific patterns of thought with respect to facts and experiences [of a given]subject matter".⁴¹

Religion is fluid and may not be forced into a static construct. Data collected in this research showed that participants perceive not only changes in the nature of their preferred religion, but also how such religious change and preference affects their religious identity. But the fact that contemporary Ghanaian Christianity and Islam tend to build on Ghanaian Traditional Religious worldviews has been studied and emphasized by some scholars.⁴² This means that religious change takes place within a given cultural background and religious thinking and how it shapes a person's approach to science are most likely to have cultural connotations.

Given the national interest for scientific advancement in Ghana, it is recommended that stakeholders conduct more research to understand correctly the contours of attitudes that are likely to give birth to a Ghanaian cultural embodiment of science. By reducing religious attitudes to assessable units of judgement, stakeholders and designers of science education in Ghana can become more effective in their interventions. However, such interventions must be conscious that models are no more than representations and are limited in the extent to which they can match the complexity of the reality they represent. This caution notwithstanding, the models discussed in this research suggest that the average student in Ghana is likely to be influenced by a

⁴⁰ J. F. Haught, *Science and religion: From conflict to conversation* (New Jersey: Paulist Press, 1995); I. Barbour, *Religion in an age of science* (New York: Harper & Row, 1990).

⁴¹ S. K. Appiah, *Africanness-inculturation-ethics: In search of the subject of an African Christian ethic*. Frankfurt: Peter Lang), 26, footnote 70.

⁴² Asamoah-Gyadu, Signs, wonders, and ministry: The Gospel in the power of the Spirit. In *Evangelical Review of Theology*, 33(1), (2009), 32-46; N. Omenyo, William Seymour and African Pentecostal historiography: The case of Ghana. In *Asian Journal of Pentecostal Studies*, 9(2), (2006), 244-258. K. Bediako, *Christianity in African: Renewal of a non-western religion*. (Edinburgh: Orbis, 1995).

religious conceptual framework which they “perceive as a proven and effective [response] to critical situations of life”.⁴³If further research can confirm this finding,its implications for designing the curriculum for science and religion education in Ghana, which will integrate religion and science and help move away from the conceptualization of religion as magic⁴⁴ cannot be overemphasized.

⁴³ L. J. Luzbetak, *The church and cultures: New perspectives in missiological anthropology* (Maryknoll: Orbis Books, 1998), 160.

⁴⁴Harris, Magic, science and theology in African development.*Evangelical Review of Theology*, 35(1), (2011), 17-30.