Youth Understanding of Climate:

Towards a theory of social adaptation to climate change in Africa

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ABSTRACT

Little work has been done to integrate behaviour change theories into climate change communication and adaptation research. This study proposes an integrated model of Social Adaptation to Climate Change with a framework to predict climate adaptation behaviour through a chain of relationships starting with media impact on climate knowledge, knowledge impact on human cognition and human cognition on climate adaptation behaviour. The study analyses a survey of literate youth in tertiary institutions within the Tamale Metropolitan Assembly of Ghana to answer key research questions such as a) how does the youth understand and react to climate change? b) Is media coverage significantly related to public knowledge of climate change? c) Is climate knowledge significantly related to human cognition on climate change? and d) is human cognition significantly associated with climate adaptation behaviour? The key findings of the study are that; a) climate knowledge is generally high among the educated youth within the study area; b) media has no significant impact on climate knowledge; c) climate knowledge is significantly associated with human cognition and; d) human cognition is significantly related to climate adaptation behaviour. These findings provide evidence to support the theoretical frame of this study and bring fresh perspectives to the field of climate research. The main conclusion of this investigation is that understanding and predicting climate adaptation behaviour can be enhanced through integration of hitherto fragmented areas of research namely media coverage of climate change, public knowledge of climate change and behaviour change theories. This has the added advantage of allowing for attention to be given to the human aspects of the climate adaptation initiatives.

INTRODUCTION

Research on communicating climate change has been recognised since the 1980s as one of the key areas of tackling the growing threats of global impacts on anthropogenic climate change (Moser, 2010). Communicating to educate, inform and raise awareness of the public on the urgency of climate change has been at the centre-stage of the climate communication discourse, viewed as a means of increasing the cognitive capacity of the individual for adaptation and mitigation purposes (Pruneau, Khattabi & Demers, 2010), ensuring greater public understanding and engagement on climate policy (Ockwell, Whitmarsh & O'neil,2009; Pew Center,2009), fostering behaviour changes in relation to energy usage, consumption preferences and environmental practices(Leiserowitz, Maibach, Roser-Renouf & Smith, 2010a), tackling the current and potential health effects of climate change(Frumkin & McMichael, 2008; Commonwealth Secretariat, 2009) and bridging the gap between science and society (Fischhoff, 2007).

Grothmann and Patt (2005: 202) argue that a continuous neglect of cognitive adaptive capacity of individual actors on climate change will undermine efforts of attaining the goals of current and future adaptation strategies because improving human cognitive adaptive capacity will contribute in addressing the shortcomings of limiting the determinants of adaptive capacity to only 'economic, social, institutional and technological situation'. Focused research on socio-cognitive indicators is of particular interest because improving individual adaptive capacity through 'well- defined model of human decision-making' promises immediate results on adaptation initiatives than increasing 'wealth' perceived as the most important determinant of adaptation(Grothmann & Patt, 2005:209). Widespread poor perception of the individual ability to mitigate and adapt to changing anthropogenic climatic conditions, linked to poor understanding of connection between human behaviour and lack of knowledge of the causes of climate changes are some of the cognitive challenges facing communicators and educators on climate change (Pruneau, Khattabi & Demers, 2010). There is the urgent need for climate communication research to break cognitive, socio-psychological and behavioural challenges to human adaptive capacity in the world, particularly in Africa since the continent according to Boko et al (2007) is the weakest in terms of resource and institutional adaptive capacity.

Media representation of climate change has been researched to understand the role of the media in the climate debate. Whilst there is a greater potential of the media to represent a very important source of educative information to the public on climate change, it has been criticised for being the main source of controversy, poor understanding and lack of certainty

on climate change (Corbett & Durfee, 2004). Overemphasising the climate debate and downplaying the consensus as well as giving equal weight to opinions of both climate scientists and fringe non-scientists are among the several factors cited in support of the media's negative role in promoting climate change knowledge (Corbett & Durfee, 2004; Moser, 2010; Carvalho,2007; Wilson,2002; Weingart, Engels, & Pansegrau, 2000; Boykof, 2007; Dirikx & Gelders,2008; Nisbet, 2009).

Understanding public knowledge on climate change is a crucial component in the climate communication process. Understanding the views, attitudes, and beliefs of the public on climate change will be very instrumental in the climate adaptation and mitigation process (Leiserowitz, Maibach, and Roser-Renouf, 2009; Shome and Marx, 2009). Several opinion surveys involving the American public, including intergenerational surveys have been conducted to understand the general public knowledge about climate change and to identify the appropriate media of engaging and further communicating climate information to the public (Leiserowitz, Maibach, and Roser-Renouf, 2009; Rabe and Borick, 2008). Most of these surveys have established the growing awareness of the reality of climate change impact among the subjects studied. Opinions differ greatly among the same subjects on the nature of solutions needed to address the problem as well the degree of responsibility of the individual and state institutions in the mitigation process.

Scholarly research recognising the importance of communication and public knowledge, views and preferences on climate change as well as individual cognitive adaptive efficacy have largely been focused on the developed world further neglecting the most vulnerable continents especially Africa. With the exception of a few (Brechen, 2003; Leiserowitz, 2007; BBC, 2009), most of the literature reviewed on the topic so far (see for instance, Fischhoff, 2007; Maibach and Priest, 2009; Kreps and Maibach 2008; Novelli, 2008; McMichael & Nyong, 2008; Nisbet, 2009; Brechin, 2003; Carvalho, 2007; Ockwell et al, 2009; Leiserowitz et al, 2010; Anderegg, 2010; etc) have been centred on the West. This lack of specific literature on public knowledge, views and attitudes about climate change communication in Africa and the fragmented nature of research in the field have created gaps that need to be filled.

Whereas Grothmann and Patt (2005) investigated the importance of individual 'risk perception and perceived adaptive capacity' in the climate change adaptation process, they failed to explore how these are influenced by other social variables especially the role of the media in that process. Also, Leiserowitz, et al. (2008), Rabe and Borick (2008), Brechen (2003), BBC (2009) and others tend to focus their studies on public knowledge, views,

attitudes and preferences without engaging behaviour change theories to explain the behavioural implications of their findings on the overall climate change adaptation process. Studies conducted by Corbett and Durfee (2004), Moser (2010), Carvalho (2007), Wilson (2002), etc. also tend to emphasise the negative role of the media to the neglect of its positive role in the climate change adaptation and mitigation process.

This research therefore seeks to bridge the gap between these fragmented studies by proposing a predicted model of social adaptation to climate change which attempts to explain and predict climate adaptation behaviour through a chain of relationships from media coverage, public knowledge, perceived human cognition to perceived climate adaptation behaviour. Situating the study within the frameworks of behavioural change theories such as social cognitive theory (Bandura, 1986), theory of planned behaviour (Ajzen, 1991), and the transtheoretical model of behaviour change (Prochaska, et al., 1998), this project collected and analysed a representative survey data on youth opinion about climate change. The study hopes to contribute to existing knowledge on climate change communication in four principal ways. First, by analysing an empirical data on youth understanding, views, preferences, and attitudes about climate change, this project will contribute to addressing the global lack of climate data with respect to public opinion particularly in Africa (Brechin, 2003, BBC, 2009). Second, an investigation of the current media through which the youth access information on climate communication will allow for an examination of the relationship between current communication media and public knowledge on climate change. Third, this study explores the impact of public knowledge on human cognition and behaviour change intentions on climate change adaptation. Last, the study aims to propose a predicted model of social adaptation to climate change as an attempt to provide a comprehensive framework for bringing together different aspects of climate communication research into a single body of knowledge. The study is organized in the following sections: Section one introduces the topic, purpose and background of the study. Section two reviews existing literature on the topic, outlines the framework that guides the research, and introduces the objectives and questions for the study. Section three entails the design and methodology as well as the limitations of the study. Section four presents the findings, interpretation, discussion, conclusion, contribution of the study to knowledge in the field, and indications for future research.

LITERATURE REVIEW

The United Nations Framework Convention on Climate Change (UNFCCC)(1992, art.1 Para 2) defines climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods…" The term adaptation as it pertains to climate change according to Smit et al (1996, cited in Smit, Burton, Klein & Wandel, 2000 p.228) "includes all adjustments in behaviour or economic structure that reduce the vulnerability of society to changes in the climate system". It is important to note that human action in adaptation has the greatest potential in reducing the adverse effects of climate change which in itself is a result of the actions of humanity (Smit, et al., 2000). The United Nations (cited in Kalas and Finlay, 2009:9) considers climate change as "the defining human development challenge of the 21st century". Human vulnerability to the effects of anthropogenic climate change is assuming greater proportions globally with significant devastating consequences on poorer countries especially in Africa. The least responsible, less informed and largely neglected on issues of climate change are the people that carry the greatest burden of climate change (Kalas and Finlay, 2009; BBC, 2009). The need to develop effective adaptation and mitigation strategies has become very crucial in the global fight against climate change. This section presents a review of existing literature on behaviour change theories that can impact adaptation and mitigation of climate change, media coverage and public knowledge of climate change in order to formulate a predicted model of social adaptation to climate change, as the conceptual frame of the study. The review is motivated by the purpose of this research which seeks to bring these three areas of empirical work on climate change into a single study while making connected meanings and providing a comprehensive framework for climate change communications research.

Behaviour Change theories and Climate Change Adaptation

Psychology has played significant role in formulating theories to explain and predict human behaviour. Behaviour change theories provide the basis through which social intervention projects and strategies are carried out, especially in the field of communication. The application of behaviour change theories to climate communication research is yet to gain the needed attention (Grothmann and Patt, 2005). This section of the study reviews key behaviour theories to identify how critical they are in relation to the climate communication research process.

Social Cognitive Theory

Social cognitive theory according to Bandura (1982, 1986, 2001) recognises human behaviour as interacting in a 'triadic reciprocality' with cognitive and other personal factors as well as environmental events, all operating as interacting determinants of each other. The triadic model of reciprocal determinism postulates that behaviour, cognitive and other human factors, and environmental influences are all interactive determinants of each other. This is in contrast to theories that portray human behaviour as a sole function of environmental influences to the neglect of individual cognition and personal factors (Bandura, 1986). Central to the theory of social cognition in explaining behaviour is the concept of self-efficacy. Self –efficacy involves an individual's inner feelings or beliefs of his/ her capability to perform certain task or engage particular behaviour. Judgements of self-efficacy influences the choices of activities and behaviours individuals tend to perform and also how long they will persevere in such activities or behaviours in the face of difficulties. According to Bandura (1982: 123), "When beset with difficulties people who entertain serious doubts about their capabilities slacken their efforts or give up altogether, whereas those who have a strong sense of efficacy exert greater effort to master the challenge".

Self-belief of efficacy is central to the theory of human agency which seeks to explain individuals' abilities to control events that affect their lives. Bandura (1989: 1175) notes that, "among the mechanisms of personal agency, none is more central or pervasive than people's beliefs about their capabilities to exercise control over events that affect their lives". He further stressed the fact that "much human behaviour is regulated by forethought embodying cognized goals, and personal goal setting is influenced by self-appraisal of capabilities" (Bandura, 1989:1175). The key element of human agency is the ability to generate actions for given purposes irrespective of whether those actions produce desired or detrimental consequences (Bandura 2001). Social cognitive theory recognises the importance of other motives of behaviour such as individuals' judgements of the likely consequences of certain behaviours (outcome expectations), their abilities to control their behaviours and the outcome of such behaviours (self-control), their abilities to cope with emotional stimuli (emotional coping), and to acquire behaviours by observing actions and outcomes of other's behaviours (Observational learning) (Bandura, 1986, 1982, 2001). Another significant component of social cognitive theory is the extension of human agency to collective agency. This conception of agency is of particular significance to climate change communication and adaptation because it underscores the importance of collective action in addressing climate effects. Bandura (2001: 14) observes that;

Peoples shared belief in their collective power to produce desired results is a key ingredient of collective agency. Group attainments are the product not only of the shared intentions, knowledge, and skills of its members, but also of the interactive, coordinated, and synergistic dynamics of their transactions.

Theory of Planned Behaviour

The theory of planned behaviour represents an extension of the theory of reasoned action through the addition of a variable known as the perceived behavioural control which "refers to people's perception of the ease or difficulty of performing the behaviour of interest" (Ajzen 1991: 183). The core element of the theory of planned behaviour is an individual's intention to perform certain behaviour. Intentions contain key motivational factors that influence people's behaviours. Intention give appropriate indications of the degree to which people are willing to try and how much effort they intend to commit to perform behaviour especially in the face of difficulties (Adjzen 1991; Bozionelos and Bennett, 1999; Armitage and Conner, 2001). The predictive determinants of intention include attitude towards the behaviour, subjective norms and perceived behavioural control. According to Ajzen (1991:188);

> The theory of planned behaviour postulates three conceptually independent determinants of intention. The first is the attitude towards the behaviour and refers to the degree to which a person has a favourable or unfavourable evaluation or appraisal of the behaviour in question. The second predictor is a social factor termed subjective norm; it refers to the perceived social pressure to perform or not to perform the behaviour. The third antecedent is the degree of perceived behavioural control which,....refers to perceived ease or difficulty of performing behaviour and it is assumed to reflect past experience as well as anticipated impediments and obstacles.

The perceived behavioural concept in the theory of planned behaviour is most compatible with Bandura's conception of perceived self-efficacy (Ajzen 2001). Godin, Conner, and Sheeran (2005: 497) applied the theory of planned behaviour to six predictive behaviours such as smoking, driving, exercising, etc. and discovered that "participants whose intentions were more aligned with their moral norm were more likely to perform behaviours compared with participants whose intentions were more aligned with their attitude". Godin, Conner and Sheeran (2005: 507) further noted that the theory of planned behaviour "should more clearly acknowledge the importance of internalized norms and self-expectations in development of one's motivation to adopt a given behaviour". This observation clearly creates a much closer linkage between the theory of planned behaviour and that of social cognitive theory.

The Transtheoretical Model

The transtheoretical model seeks to explain change as a process of six stages where individuals move through the stages of precontemplation, through contemplation, preparation, action, maintenance and finally, termination (Prochaska, Johnson, & Lee, 1998; Prochaska & DiClemente, 1983). The precontemplation is the stage where people do not intend to make changes to their behaviour in the near future, usually within the next six months. Contemplation is the stage where the intention to change behaviour within the next six months is made clear while the individual still struggles to settle between the pros and cons of the decision to change. The preparation stage is where the individual designs a plan of action and intends to execute that in the immediate future, usually within a month. The action stage is where people do make actual change, and the maintenance stage is where they work to prevent relapse. The termination stage is where the behaviour becomes part and parcel of the individual's life and is therefore maintained (Prochaska, et al., 1998). Prochaska and DiClemente (1983) applied the transtheoretical model to the study of self-change of smoking by comparing how self-changers use the ten processes of change across the five stages of change as compared to relapsers. The study found that subjects in the precontemplation stage used the least of the processes of change, whilst those in the contemplation stage "are most likely to respond to feedback and education as sources of information about smoking". Subjects in the action stage "use both counterconditioning and stimulus-control procedures for actively changing their smoking behaviours and environment", report "more self- and social reinforcement for their changes and rely more on helping relationships for support and understanding" (Prochaska and DiClemente, 1983: 394). Prochaska et al. (1994) applied the transtheoretical model to the study of 12 behaviour problems including, smoking cessation, weight control, radon gas exposure, exercise acquisition, etc. and discovered that "clear commonalities were observed across the 12 areas, including both internal structure of the measure and the Pattern of changes in decisional balance across stages" (p.39- 44).

The above theories present new insights into understanding human behaviour as it applies to climate change communication research. Climate communications researchers need to integrate behaviour change theories into their studies to enhance their abilities to predict human behaviour in achieving positive results in relation to climate adaptation and mitigation. Understanding the levels of individual self- efficacy, outcome expectations, self-control or perceived behavioural control, behavioural intentions as well individual's stage in the behaviour change process is important for climate change communication research and practice. This knowledge will help climate change communicators to present information in

ways that will increase individual confidence, provide the needed motivation and rewards for action and to shape positive attitudes and intentions. Pruneau, et al. (2010) underscore the fact that despite increasing awareness of the reality, the current and future impacts of climate change, observed lack of knowledge of the connection between human actions and climate change, poor perception of human capability to control climate change, the difficulty of the human senses to perceive current impacts of climate change etc. are among the cognitive challenges facing climate change communication. Grothmann and Patt (2005: 203) argue that 'if agents systematically underestimate their own ability to adapt, this qualifies as a more important bottleneck for adaptation than the objective physical, institutional and economic constraints'. A study by Grothmann and Patt (2005) in Germany and Zimbabwe applying the process Model of Private Proactive Adaptation to Climate Change (MPPACC), found that socio-cognitive factors are significant in explaining human adaptation to climate change. This study by Grothmann and Patt represents a significant attempt to integrate behaviour change theories to climate change adaptation, especially their emphasis on the importance of perceived adaptive capacity to climate change adaptation. The observed limitation of Grothmann and Patt's study is their concentration on the power of cognitive theory to explain climate change adaptation without engaging in broader discussion of the role of other environmental factors such as the communicative media in shaping human knowledge and cognition. This study therefore attempts to avoid this limitation by giving equal importance to environmental factors (such as the communicative media and public knowledge) in shaping human cognition as much as human cognition in predicting climate change adaptation behaviour.

Media Coverage of Climate Change

The importance of the communicative media as a source of information and knowledge about issues affecting human lives is increasing in greater proportions in the mediatised 21st century society. The media represents a significant source of citizens' knowledge on almost any issue affecting human life including science and technology. According to Corbett and Durfee (2004: 130), "for most citizens, knowledge about science comes largely through the mass media, not through scientific publications or direct involvement in science". Stated otherwise, Nelkin (1995 cited in Corbett and Durfee, 2004:130) underscores a similar point that people's understanding of science is "less through direct experience or past education than through the filter of journalistic language and imagery". Recognition of the importance of the media's role in presenting scientific knowledge to the rest of society, has led many researchers to undertake studies on the role of the media in constructing public knowledge and views about climate change. Current studies have revealed that the media is playing a

more negative role in advancing public perception of certainty on climate change (see for instance Corbett and Durfee, 2004; Moser, 2010; Carvalho, 2007; Wilson, 2002). Corbett and Durfee (2004:142) in a study of media representations of global warming found that "the inclusion of controversy *variable* reduced perceptions of certainty" of global warming among the surveyed public (emphasis mine). They argued that, "in the case of global warming, the media have more often than not overplayed the level of uncertainty about global climate change" (Corbett and Durfee, 2004:134). Wilson (2002) found significant ignorance and misinformation about basic science of climate change among weathercasters in the USA. However, overemphasising the negative impact of the media on public knowledge of climate change, in the opinion of the writer, limits the ability of those engaged in climate change communication research to understand other areas of media influence on public knowledge of climate change. Research on media coverage of climate change should give attention to the positive role the media plays or can play in promoting public understanding of the subject and how policy makers can properly engage the media in this project. Weingart, et al. (2000) demonstrated how the German media within two decades (1975-1995) translated scientific hypothesis of climate change into certainties, thereby inviting public engagement and action on needed behaviour changes. This has the greater tendency of improving public understanding of the subject which brings the subject of climate change into the daily experiences of people and has the potential of improving individual self-perceived cognition. In the following section, the study discusses issues of public knowledge, views and attitudes about climate change and how these can be translated into improved human cognition for effective climate change adaptation.

Public knowledge, Understanding and Views about Climate Change

Current literature demonstrates significant increase in general awareness of climate change among individuals especially in the western world. Within two decades, from 1981 to 1997, the percentage of people who heard about climate change had increased from 38 to 88 (Corbett and Durfee, 2004). Recent surveys by Rabe and Borick (2008), Leiserowitz, et al. (2010a; 2010b) found relatively high awareness of climate change among the American public. However, a study by Leserowitz et al, (2010) found the climategate scandal, the shift of media attention away from issues of climate change, rising distrust of scientist etc. to have caused a declined in public opinion of climate change between 2008 and 2009. Understanding diversity of opinions, risk perceptions, policy preferences, and individual commitment to climate change issues, has been considered critical in understanding public stance on the issue and the framing of educational and communication messages to effectively engage them.

A report of nationally representative surveys of Americans by Leiserowitz, et al.(2010a, 3) identified six distinct groups (namely, alarmed, cautious, concerned, unconcerned, doubtful and dismissive) known as 'global warming's audience among the public'. Each group shares distinct characteristics in terms of beliefs about the reality, causes and consequences of climate change, climate policy preferences and willingness to engage in climate relevant behaviours, values, demographics, religious beliefs, and Pattern of media usage. On one extreme side, the alarmed group believes strongly in the reality, human cause, and scientific consensus about climate. They worry about climate change and are most likely to support national policies and individual behavioural changes necessary to reduce the impact of climate change. On the other extreme side, the dismissive group denies any reality of climate change and are most likely to oppose any state policy or individual behavioural change initiative aimed at reducing the impact of climate change. A study by the BBC (2009) in ten African countries discovered among other things that climate change is poorly understood among the populations and people have the tendency to hold themselves responsible for climate change rather than global industrial practices.

In a cross-national study of public opinion on climate change, Brechen (2003:111) notes that there is generally broad perception of global warming as a "somewhat serious problem" with the exception of Nigeria, the only African country included in the study. This view has been shared by Leserowitz (2007) who observed that, a) general awareness of global warming was very high in the developed countries but low in the developing countries; b) global warming was largely considered as somewhat serious problem, a perception that has increased over the years and; c) global warming was considered by a large majority as representing a national threat within the next ten years. Brechen therefore argues that if broad cross-national consensus could be observed a decade ago, it is expected that such a consensus would increase as of today since science certainty on the issue has become entrenched within the last decade.

Understanding public knowledge on climate change is important in the global project of reducing the effects and impacts of the subject as well as promoting adaptive and mitigation behavioural changes among vulnerable populations, but climate change communication researchers need to go beyond just understanding public knowledge of the issues to raising questions of what public knowledge of climate change mean for human cognition and perceived self-efficacy in climate change adaptation. Current studies on public knowledge of climate change including those discussed above, tend to focus on how people view and react to the subject of climate change without going further to investigate what these views and reactions mean for other areas of knowledge especially behaviour change theories on climate

change. This suggests a limitation in current research on climate change especially research on public knowledge because it limits our understanding of how the various areas of climate change communication research are connected, leading to lack of comprehensive study of the subject. This study tries to overcome this limitation by linking public knowledge of climate change to media coverage of the subject and behaviour change theories and how these help to shape the climate change adaptation process as conceptualised in the next section.

Conceptual Framework

The review of empirical literature and theories of behaviour change, media coverage and public understanding of climate change above demonstrate a wealth of knowledge generated over the years which can be applied to significantly advance the course of climate change communication research. The social cognitive theory, (Bandura 1986) highlights the importance of perceived self-efficacy in predicting behaviour change, which can apply to climate change adaptation. Improved public knowledge and provision of reliable and effective information especially through the media can have beneficial impacts on human knowledge and cognition leading to desired behavioural changes necessary for climate change adaptation. The impact of the communicative media in promoting certainty (Weingart, et al., 2000) or otherwise (Corbert and Durfee, 2004) of climate change has significant ramifications for the climate change adaptation and mitigation project. Public knowledge of climate change, though still largely non-existent in developing countries (Brechen, 2003, BBC, 2009) has been rising steadily over the last three decades in western countries. This is a positive indication for climate change communication research and a testimony of the potential of climate change communication to achieve the desired behavioural changes responsible for climate change adaptation and mitigation.

The importance of the above key areas of climate change communication research cannot be over-emphasized. However, little research has been done on the potential of how these key areas of research can be connected to understand and explain their interactive influence on climate adaptation and mitigation. The purpose of such a research is to understand how connected meanings can be drawn from these key research areas and to explore the influence of media on public knowledge of climate change, the impact of public knowledge of climate change on human cognition, and the impact of human cognition on climate change adaptation and mitigation behaviour. Such a project will provide several benefits to knowledge on climate change communication research. First, it will bring together fragmented areas of knowledge on the subject into a single project. This means connecting otherwise scattered research projects and human efforts into a streamlined field of

investigation that makes connections to various research projects on the subject of climate change possible and desirable. Second, bringing these various areas of research into a single body of investigation means simple theoretical models can be developed to offer understanding and direction to knowledge on climate communication research in general terms. Last, this project will ensure that the accumulated knowledge of social psychology and communication research can be applied to addressing the problems of climate change.

Drawing mainly from the Bandura's social cognitive theory and the process Model of Private Proactive Adaptation to Climate Change (MPPACC) by Grothmann and Patt, this study conceptualises a Predicted Model of Social Adaptation to Climate Change (PMSACC) to predict and understand how the chain of interactions among media coverage, public knowledge and human cognition on climate change lead to adaptation behaviour. The PMSACC (figure 1 below) is intended to explain and predict climate change adaptation behaviour as a function of the influences of public knowledge, media coverage and human cognition.

Figure 1: Predicted Model of Social Adaptation to Climate Change
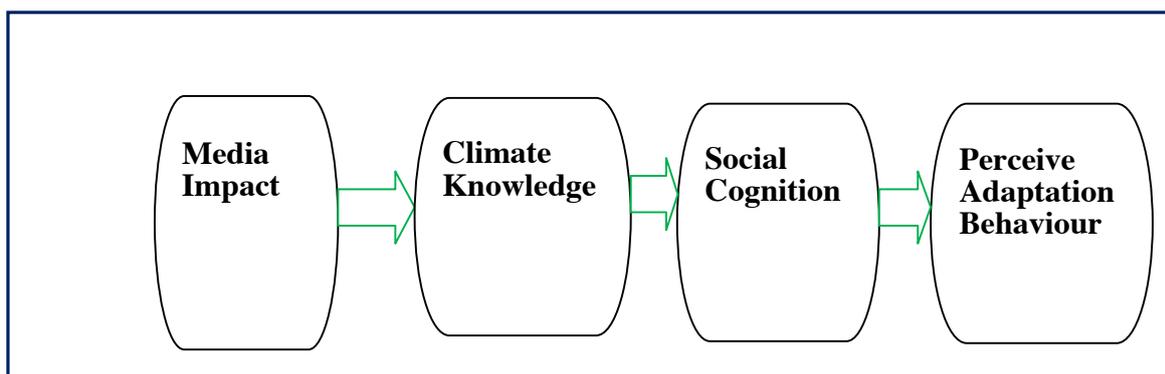
Source: Adopted and modified from Bandura's 1986 Social Cognitive Theory

The above model postulates that climate knowledge is influenced by media coverage, public knowledge impacts on human cognition and human cognition influences climate adaptation behaviour. Media coverage that emphasises on certainty leads to improved climate knowledge whilst media emphasis on uncertainty leads to poor climate knowledge. Improved knowledge leads to high perceived self-efficacy whilst poor knowledge leads to low perceived self-efficacy. High perceived self-efficacy leads to perceived adaptive behaviour whilst low perceived self-efficacy leads to maladaptation behaviour.

Research Objectives

This research is a response to global threats posed by anthropogenic climate change particularly on Africa. Boko et al, (2007) echoed the fact that people in the developing world, particularly Africa, are the most vulnerable to climate change impacts because the material (economic) and institutional capacities of this part of the world are very weak. One critical, reliable, and most efficient way of improving countries adaptation capacities according to Grothmann and Patt (2005), is by increasing human cognitive capacities through continued public education and communicating in ways that motivate certain behavioural changes necessary for mitigation and adaptation to climate change. Therefore understanding public knowledge of climate change and how it is influenced by media coverage of the subject as well its influence on human cognition is crucial for climate change communication research. Data on public opinion is limited even in western countries (Brechen 2003) and largely non-existent in Africa (BBC, 2009). This study will therefore contribute to existing knowledge on climate change communication research by proposing a model that brings together three key areas of research on the subject in order to ensure that connected meanings can be drawn from these areas and their combined explanatory powers on climate adaption explored. The benefits of this type of study include among others, the bringing together of fragmented areas of knowledge about climate communication research and applying the wealth of knowledge from social psychology research to the problem of climate change. To achieve the objectives of the study, a central research question and three hypotheses will be explored;

Research Questions (RQ);
RQ1. What do Ghanaian youth know about climate change in terms of its reality, causes, and impacts and what are their views, attitudes and believes about it?

Hypothesis One (H1)
$H1_o$: There is no significant relationship between media coverage and public knowledge of climate change.
$H1_a$: There is a significant relationship between media coverage and public knowledge of climate change.

Hypothesis Two (H2)
$H2_o$: There is no significant relationship between public knowledge and human cognition on climate change.
$H2_a$: There is a significant relationship between public knowledge and human cognition on climate change.

Hypothesis Three (H3)

H3$_o$: There is no significant relationship between perceived human cognition and perceived adaptation behaviour to climate change.

H3$_a$: There is a significant relationship between perceived human cognition and perceived adaptation behaviour to climate change.

RESEARCH DESIGN AND METHODOLOGY

This study employed a survey strategy and questionnaire design method to empirically gather the necessary data to answer the above research questions. The primary goal of this research is to capture the current understanding and general opinion, views, beliefs, attitudes of the youth in Ghana, understand how this knowledge interacts with current sources of climate change information and human cognition, and the overall impact of this interaction on climate change adaptation. This makes survey the most appropriate for this kind of exercise. According to (Denscombe, 2010:12), 'surveys are used to the best effect when a researcher wants collecting factual information relating to groups of people: what they do, what they think, who they are'. A survey strategy employing the use of questionnaire design instrument has several benefits which can contribute significantly in enhancing the findings of this particular dissertation. Among the several benefits that this study will get by employing this combination of strategy and method are; a) it will allow for a wider and inclusive coverage of the subjects studied making it possible to conduct a representative study and to generalise the opinions gathered to the larger population; b) it is best suited for gathering information about a population within a specific time period; c) it allows comprehensive and detail views of a situation and can be used to gather both qualitative and quantitative data; c) it is cost effective and time efficient, making it suitable for time-bound and less resourced student studies(Fowler, 2001; Denscombe, 2010).

Other research methods were critically considered but rejected in the end because they were not found to be suitable for the nature or the particular circumstances of this study. The ethnographic method could have been useful in capturing deeper feelings of the subjects in relation to their views, attitudes and opinions on climate change and their perceived self-efficacy in adapting to climate change. However, this would have required extended time being spent by the researcher among the subjects, a requirement that will make it impossible for this dissertation to be submitted within the stipulated time frame (Geertz, 1975). Using depth interviews seemed promising in the initial analysis because it is the widely used

method of gathering data in the social sciences (Holstein and Gubrium, 1997) but the method was rejected because it was practically impossible to apply such a method in gathering a representative data under the current circumstances of this study. In addition to the above reason, the depth interview method was rejected because it is suitable for gathering detailed information about specific issue(s) under investigation, whereas this study mainly sought to gather information about broader issues without much detail (Denscombe, 2010; Gaskell, 2000; Berger, 1998). Content analysis could have been a useful method of conducting the research, but that would have been more appropriate to understanding media coverage of climate change and not public knowledge, human cognition and the interactions among these areas of climate knowledge (Bauer, 2000; Hansen et al., 1998). The content analysis method could have been combined with the survey method, but the fact that current research has focused on the negative role of the media in climate change coverage (Corbett and Durfee, 2004) means analysis of media content on the subject would have been less comprehensive. Despite the suitability of survey method to this study, problems such as interpretation biases, restrictions in answer options especially in the case of pre-coded questionnaires, lack of quality control, etc. associated with the survey method could have impacted on the research process.

In summary, this study employed a survey methodology to empirically collect and analyse data on issues of climate knowledge, media usage and coverage of climate change, and human cognition within the Tamale Metropolitan Assembly of Northern Ghana. The choice of survey method has several benefits for the research. In the first instance, the method allowed for a representative data to be collected whilst capturing the individual opinions of the youth on the various variables investigated. An entire pre-coding of the questionnaire also allowed for research questions and answers to aligned to the research design, theory, and conceptual framework. Not all, the fact that questionnaires were self-administered meant the absence of interviewer influence or biases in the responses obtained. The assurance of anonymity both in the design of the questionnaire and the nature of administration ensured responses were given without the influences of fear or favour.

Limitations

The findings of this study need to be interpreted in line with its methodological limitations. First of all, the survey questionnaire was entirely closed-ended, meaning that the subjects could have been forced to pick choices that did not really reflect their preferences or personal circumstances. This could also mean pre-empting responses from the subjects. Also, limiting the survey to only the literate youth means that generalizing the results of this study to the entire youth population of the study area can have significant problems. The measure of media coverage as reported in this study only measured the participants' perception of media coverage and not actual measure of the variable. An alternative measure could have been to do content analysis of media coverage of the subject. A focus on quantitative methodology means the benefits of qualitative data was not explored.

Population, Sample, and Sampling Procedure

A representative sample of hundred and fifty (150) respondents were selected from a population of about three thousand (3000) students studying in five (5) tertiary institutions within the Tamale Metropolitan Assembly, namely, the University for Development Studies, Tamale Polytechnic, Tamale College of Education, Bagabaga College of Education and the Tamale Nurses Training College . A systematic random sampling procedure was used in selecting respondents in four of the institutions where numbers were less and obtaining student registers proved not so difficult. With regards to the University for Development Studies, student numbers were very large and obtaining list of student register could not be possible. Therefore a random sampling procedure was used to narrow down the various subject classes and levels of courses and to select respondents within this narrowed sample frame through random sampling. Principles of anonymity, privacy, non-commercial use of survey data and other ethical issues were discussed with each respondent before he or she deciding to participate in the study. The sample was drawn from the elite youth for two main reasons. One, understanding climate change issues from the perspective of the youth adds to overall understanding of the subject among the general population. The second reason is that a research conducted by BBC (2009) had a focus on the two extremes of the populations, the upper elite made up of politicians and policy makers, and the peasants and ordinary traders who represent the illiterate class. The research data was collected within two weeks with the help of two research assistants. A total of hundred and thirty (130) questionnaires representing a return rate of 87% were returned at the end of the period. The respondents were in the age's range of 18-34 and involved in studies at various levels including diplomas,

degrees, and masters programmes. The age distribution of respondents was that, 47% were between the ages of 18-24; 30.8% between 25 and 27; 16.2% between 26 and 32; and 5.4% above 33 years. Females accounted for 43% while's males accounted for 57% of the respondents. 42% of the respondents were studying for undergraduate and postgraduate degrees whilst 58% for diplomas and certificate programmes.

Design of Research tools

The survey data was collected using self-administered questionnaire instrument. The instrument was initially administered to 20 undergraduate students of the LSE and the results revealed that certain questions could possibly be misinterpreted. The pilot therefore helped in reshaping the wording and positioning of questions to ensure that questions carry similar meaning to different respondents. The survey instrument was divided into five (5) sections with each section dealing with a set of issues. Three of the sections directly addressed issues regarding the key areas under investigation, with the two additional section providing general insights into youth and climate change in general. Section one contained questions of demography such as age, gender, marital status, level of qualification, religious and political affiliations. Section two was designed to ask series of questions aimed at testing the respondents' knowledge, views, beliefs and attitudes about climate change. Section three was designed to measure both individual and social efficacy from the perspectives of the respondents. Section four explored the respondent's access to and usage of the communicative media. Section five had questions to explore current sources of climate change information to the youth within the study area and what the individual will do with his her knowledge on climate change.

Findings, Discussion and Conclusion

The research data was captured and analysed using statistical software, SPSS. Frequencies and descriptive statistics for most variables were obtained using frequency and descriptive tools. Binary logistic and linear regression models were developed to test association and predictive ability of certain independent variables such as media impact, perceived social cognition, climate knowledge on a dependent variable, perceived climate adaptation behaviour. The test of hypothesis was intended primarily to test the fit of the proposed Predicted Model of Social Adaptation to Climate Change (PMSACC) (Figure 2 below), which proposes relations between media impact and public knowledge of climate change, public knowledge and human cognition, and human cognition and adaptation behaviour.

Figure 2: Predicted Model of Social Adaptation to Climate Change
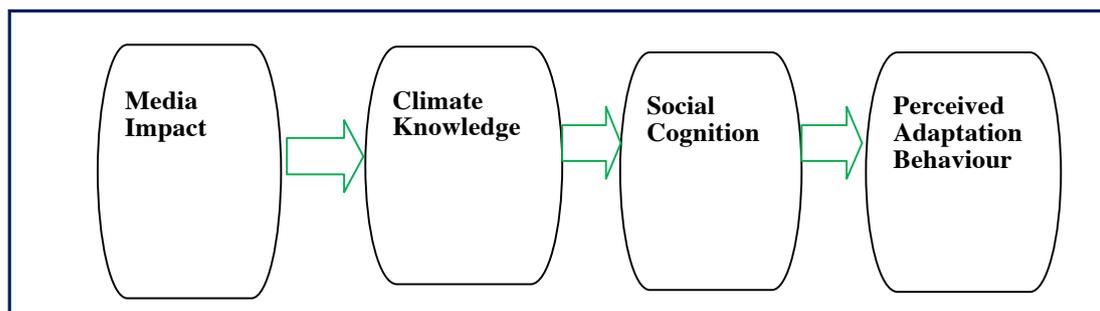
Source: Adopted and modified from Bandura's 1986 Social Cognitive Theory

The sections that follow discusses descriptive findings of the research in terms of public knowledge, views, attitudes and beliefs about climate change, a test of hypothesis and the power of the proposed model in explaining social adaptation to climate change, discussion of the findings in relation to the research questions and literature, and conclude with recommendations for policy and future research.

Findings

What do Ghanaian youth know about climate change?

 Table 4.1 below illustrates the distribution of respondents of the survey in terms of demography. A chi-square test revealed that there is no significant difference between gender, age, marital status, religion, education and political affiliation, and individuals' beliefs views and attitudes towards climate change. This finding contrast that of the research

findings by Leserowitz, et al. (2010a) that Americans were likely to share certain views on climate change based on their political views or socio-economic statuses.

Table 4.1. Frequency distributions of respondents by demography

Age	18-24	25-27	28-32	33+		
	(N=62)	(N= 40)	(N =21)	(N=7)		
Gender	Male		Female			
	(N=73)		(N=55)			
Marital status	Married		Single			
	(N=21)		(N=103)			
Qualification	UG/PG		Dip/Cert.			
	(N=54)		(N=75)			
Religion	Muslim		Christian	Others		
	(N=76)		(N=50)	(N=1)		
Political party	NDC		NPP	CPP	PNC	others	None
	(N=45)		(N=25)	(N=8)	(N=5)	(N=33)	(N=11)

Have you heard of climate change?

A significant majority of the respondents have heard of climate change (22%), global warming (28%) or both (49%). A total of 99% of the respondents have heard of at least one of the terminologies referring to the subject. A research by BBC (2009) focusing on illiterate peasants and traders in Africa, found that Ghanaians or Africans in general did not have an understanding of any of the terminologies referring to the subject. This finding indicates a departure from that observation though only within the educated youth population and not the entire population of the country. Majority of the respondents (73%) indicated they heard of the term climate change or global warming between 2001 and 2010. Twenty-three per cent (23%) of them said they heard of climate change or global warming before the year 2001 and only 4% said they heard of either of the terms after 2010. Asked if they have personally observed changes in their environment that confirms climate change is or maybe happening, 99% of the participants said yes, outlining environmental factors such as changes in weather and rain patterns, increasing draughts, among others. Figure 3 below presents a summary of more than eight factors identified by the respondents as the manifestations of climate change happening within their environments.

Figure 3: Bar Chart of factors identified as manifestations of climate change happening
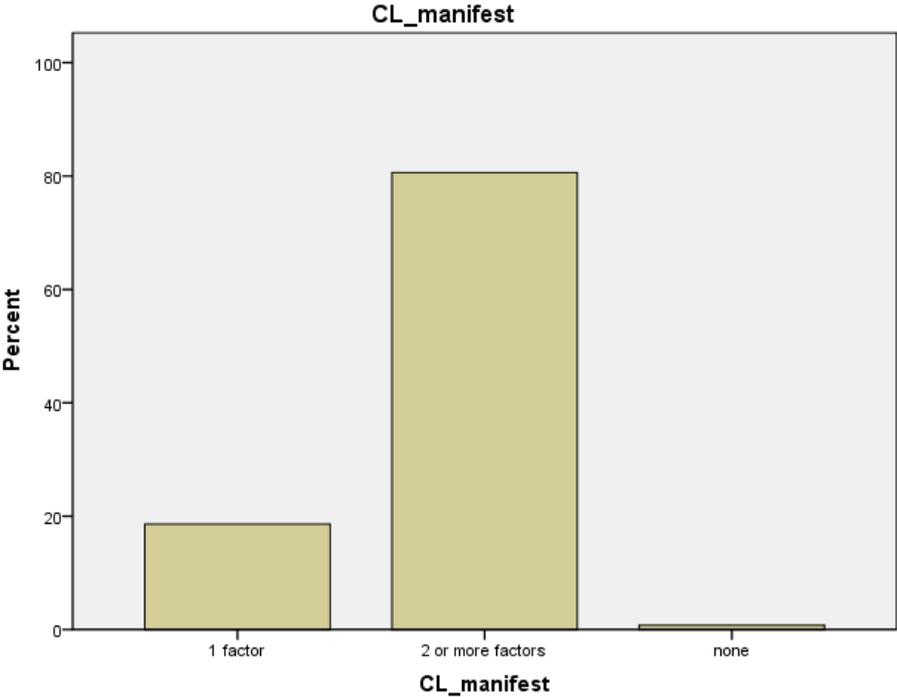
As shown in the figure above, about 80% of the respondents identified more than one factor as climate change manifestation, whilst about 19% identified only one factor.

When will climate change begin to impact negatively on Ghanaians?

Majority of the respondents (71%) felt climate change was already harming Ghanaians with 15% saying climate change will begin to impact negatively on Ghanaians ten years from now. This means that a total of 86% of the respondents believe climate change is harming people now or will begin to harm people ten years from now. This is consistent with findings by Brechen (2003), Moser (2010) that public knowledge and beliefs on climate change certainty have been increasing over the past three decades. Contrary to established knowledge however, more than half of the subjects (51%) believed climate change was a result of both human and natural activities with only 45% attributing the phenomenon to human activities. A study by BBC (2009) found that a section of the African population especially among the illiterate peasant farmers or traders do attribute climate change to supernatural forces, citing God for instance as the cause of the phenomenon. In response to how serious the problem of climate change is, 77% believe it is very serious, 14% said it is somewhat serious whilst only about 9% believing it as not very serious or not serious at all. Of the impacts of climate change the category that ranked high was faming/hunger/rising food prices (50%), followed by diseases / health impacts (27%) and then lost of environmental resources (23%). Similar trends in terms public beliefs about climate change were observed by Leserowitz, et al.

(2010a) among the alarmed group of the six types of Americans identified according to their climate views or beliefs.

Who cause(s) climate change in Africa?

Studies have noted that Africans are least responsible for the cause of climate change but mostly at the centre of the risk of the phenomenon (BBC 2009; Kalas and Finlay, 2009). This means that climate changed is caused mainly by external factors through the activities of industrialised countries but this study observes that a significant majority of the educated youth population in Ghana are yet to share this view. About 28% of the respondents believed climate change is caused internally by Africans themselves, whilst 69% believe it is caused by both internal and external factors with only 3% believing that external factors are responsible for climate change in Africa.

Is there an immediate need for action and who should be responsible for what?

Similar to the observations that most people felt climate change is serious and is already harming people in Ghana, a significant majority of them (94%) believe there is a need for immediate action to address the challenges of global climate change. Responding to the question of who should be responsible in addressing climate change in Africa, less than 10% of the respondents felt only governments and individuals in Africa need to do so. Contrary to the observation that only 3% believed climate change was caused by external factors such as the activities of industrial countries, a significant number (33%) of the subjects felt international governments and institutions need to address the impact of the global warming in Africa. This contrast in observation highlights the issue of dependency mentality and a manifestation of the burden of international development aid (Alhassan, 2009). More than half of the respondents (54%) however felt it should be a shared responsibility among African governments, individuals and international governments or institutions. Almost all the participants (99%) believe both themselves and the government of Ghana need to do something to ensure effective mitigation and adaptation to climate change. Issues that were identified as actions that the government need to take include banning importation of used cars and electronic gadgets, and educating the public on energy usage and adaptation measures to climate change. The respondents felt they, individually and collectively, needed to engage in advocacy for clean energy policies by the government, reducing their energy consumptions through behavioural changes such as switching off lights when not in use, unplugging unused electronic gadgets, walking or taking public transport instead of driving privately as well as learning and educating others on how to adapt to climate change effects.

What is your level of access and use of information and news media?

The data shows that there is significant skew in terms of access and usage of the communicative and information media among the respondents. Television and radio, which invariably are the widest spread in terms of information media in rural and even urban Africa, were ranked highest among the media sources that are being used by the participants of this study. As shown in table 4.2 below, seventy one per cent (71%) of the respondents reported viewing television at least five days a week, followed by sixty four per cent (64%) who listen to radio at least five days a week. Despite the fact that internet penetration levels are very low in developing countries and newspaper are widely spread especially in Ghana, more respondents (36%) reported using the internet at least five days per week than they reported reading newspapers (16%).

Table 4.2 Percentage of information and news media access and usage by the respondents

Usage	TV	Radio	Newspaper	Internet
Daily	66.2	60.0	12.3	30.8
Five days a week	4.6	5.4	3.8	5.4
Three days a week	7.7	3.8	6.2	11.5
Two days a week	1.5	3.8	0.8	3.8
One day a week	2.3	3.1	10.8	16.2
Less often	17.7	23.8	66.2	32.3
Total	100	100	100	100

The observation that newspapers though widely circulated in Ghana but less used by the youth can be attributed to the fact that newspapers are still sold in Ghana and most of the students being in school may not be able to buy newspapers on regular basis for information. The fast penetration of mobile telephony into the developing world as a multi-media information and communication tool may have accounted for the record of daily internet usage which is 18.5% higher than newspaper usage. The media access and usage data above shows that television, radio and the internet represent the best media through which climate change message can effectively reach the youth in the study area.

Do you get information on climate change, what about it, and through what means?

A quarter of the respondents (25%) recorded that the receive climate change information on regular basis. However, a significant majority (62%) of them said they do sometimes get information on climate change whilst 13% of them said they rarely or never get information on climate change. Of those who either regularly or sometimes get information on the subject, seventy-six per cent (76%) of them said they get this information through media sources, primarily radio and television, whilst twenty-four per cent get their information from non-media sources such as lectures and classrooms. The information gathered by the subjects from the above source ranged from causes of climate change to adapting to and mitigating the impacts of climate change. Almost all respondents (99%) said they are willing to share and educate others from the acquired information and any other knowledge on climate change as part of ensuring collective efforts to address the climate problem.

Individual and social cognition (perceived self-efficacy)

Testing the impact of the communicative media on public knowledge of climate change and the subsequent impact of the acquired knowledge on human cognition about climate change has been central to this study. The data obtained presents interesting observation in the individual's self-perception in general terms and in application to climate change. In general terms, such as being able to make change happen, the individual respondents recorded higher perceived self-efficacy than when the issues of addressing climate change were concerned. Similar trend was observed in the individual perceived social efficacy as shown in table 4.3 below.

Table 4.3 Frequencies of responses to likart scale questions on individual and social cognition

	Indiv. Gen. Cog	Indiv. Clim. Cog	Gen Soc. Cog. Clim.	Soc. Cog.
Agree Strongly	47	36	81	76
Agree	54	61	37	44
Somewhat agree	15	20	8	7
Neither agrees nor disagree	2	2	2	2
Somewhat disagree	2	4	1	0
Disagree	8	6	1	1
Disagree strongly	1	1	0	0
Total	129	130	130	130

The table above indicates that individuals perceive climate change as a social problem which demands collective rather than individual action to address. This falls within the concept of collective agency described as "peoples shared belief in their collective power to produce desired results" (Bandura, 2001:14).

Test of the Model (Hypothesis)

This section of the study presents the analysis of the binary logistics and linear regression models developed to test the fit of the proposed Predicted Model of Social Adaptation to Climate Change (PMSACC) by testing the set of hypothesis and relations between media impact, climate knowledge, human cognition and perceived climate adaptation behaviour. To design the logistics regression models for testing the hypothesis, the following variables were computed by combining multiple variables from the dataset;

a) Climate Knowledge: was computed by combing responses to questions Q1 (ever heard of climate change of global warming), Q3 (belief about climate change happening), Q6 (how climate change is caused), and Q9 (who causes climate change).

b) Media Impact: was computed by combining responses to Q2b (source of first hearing of climate change), Q25 (if gets information on climate change) and Q26 (source of information on climate change)

c) Social Cognition: was computed by combining responses to Q15 (humans can change things) and Q17 (humans can address climate change)

d) Individual Cognition: was computed by combining responses to Q14 (I can change things) and Q16 (I can address climate change)

e) Climate Adaptation: was computed by combining responses to Q10 (need for immediate action on climate change), Q12 (whether government should act or not to address climate change) and Q13 (whether individual respondent will act or not to address climate change)

Hypothesis One (H1): Test of Relations of Significance between Media Coverage and Public Knowledge of Climate Change

The statistical results obtained from a linear regression model as shown in table 4.4 below indicates that a one unit increase in media impact decreases an individual's climate knowledge by .088 units. This can be interpreted to mean that increase in media coverage of the climate change leads to decrease in public understanding of the subject. This tends to support the findings by Corbett & Durfee, (2004), Moser (2010), Carvalho (2007) and Wilson (2002) that the media gives emphasis more to the controversies surrounding climate change

issues and also downplays on the scientific consensus on the subject. The data as shown in table 4.4 below also indicates that the relationship between media impact and climate knowledge is not significant at any conventional level of significance where the observed P = 0.442. Base the above P value; we therefore fail to reject the null hypothesis of no significant relationship between the explanatory and dependent variables.

Table 4.4 SPSS output of test of relations between media impact and climate knowledge

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.471	.097		35.614	.000
	Med_Impact	-.088	.114	-.068	-.770	.442

a. Dependent Variable: Clim_Knowl

The use of linear regression model in obtaining the above data means that the researcher assumed the explanatory variable to be a continuous variable. The linear model was considered to be convenient in this case since the dependent variable had more than two outcome options and could not be suitable for the binary logistic model, and the multinomial logistic model was considered more complex and perhaps beyond the scope of this study.

Hypothesis Two (H2): Test of Relations of Significance between Knowledge and Human Cognition on Climate Change

The results of a linear regression model as shown in table 4.5 below indicates that a unit increase in climate knowledge leads to an increase of 0.930 or 93% in human cognition. This indicates a positive relationship between climate knowledge and human cognition. The results also show that the relationship is significant at the 10% level of significance where P< 0.07< 0.1=10%. We can therefore confidently reject the null hypothesis of no significant relationship between the dependent and explanatory variables based on the P value above, at the 10% significance level. This finding is consistent with Bandura's (1986) social cognitive theory which considers knowledge as being positively associated with cognition. This observed relationship between knowledge and human cognition which previous studies have failed to explore (see for instance Brechen, 2003; BBC, 2009; Leiserowitz, Maibach, Roser-Renouf, & Smith, 2010a) has a significant implication for this study and climate communication research in general. It provides a strong point for integrating behaviour change theories into climate change communication research.

Table 4.5: SPSS output of test of relations between climate knowledge and human cognition

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
		B	Std. Error	Beta	T	Sig.	Lower Bound	Upper Bound
1	(Constant)	21.411	1.688		12.683	.000	18.070	24.752
	Clim_Knowl	.930	.490	.168	1.900	.060	-.039	1.899

a. Dependent Variable: human_Cog

Hypothesis Three (H3): Test of Relations of Significance between Human Cognition and perceived Climate Adaptation Behaviour

Predicting climate change adaptation behaviour through the processes of understanding how media coverage impacts knowledge, how knowledge impacts human cognition and how human cognition impacts perceived adaptation behaviour has been the central objective of this study. The results obtained from a binary logistic regression model as shown below indicate that the odds of a person with high social efficacy undertaking adaptation behaviour is 18% higher compared with a person with low social efficacy. This is statistically significant at the 5% level of significance where $P < 0.01 < 0.05 = 5\%$. Climate knowledge and media impact variables were included in the model to test if they have direct predictive influence on perceived climate adaptation behaviour. As can be observed from table 4.6 below, neither media impact nor climate knowledge has direct significant relationship with perceived climate adaptation behaviour. The observation supports the view that information or knowledge alone does not promote behaviour change, but that people's perceptions of their ability to change things affecting them and their behavioural intentions play significant role in shaping their behaviours (Bandura, 1989; Ajzen 1991; Grothmann and Patt, 2005)

Table 4.6 SPSS output of test of relations between media impact, social cognition, climate knowledge and climate adaptation behaviour

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Clim_Knowl	.832	.668	1.550	1	.213	2.299	.620	8.520
	Ind_Cog	-.127	.162	.614	1	.433	.881	.641	1.210
	Soc_Cog	.778	.246	10.040	1	.002	2.178	1.346	3.525
	Med_Impact(1)	.607	.832	.533	1	.465	1.836	.359	9.377
	Constant	-8.846	3.235	7.475	1	.006	.000		

a. Variable(s) entered on step 1: Clim_Knowl, Ind_Cog, Soc_Cog, Med_Impact.

Discussion

The purpose of this project has been to understand and predict climate adaptation behaviour by establishing a chain of relationships starting from media impact on public knowledge, knowledge impact on social cognition and the impact of social cognition on perceived climate change adaptation behaviour. This meant bringing together different areas of empirical research such as media coverage and public knowledge of climate change and behaviour change theories into a single body of investigation in order to make connected meanings and to fully explore the potentials of these combined research areas in addressing climate change challenges especially in Africa. The research findings therefore presents new insights into climate change communication and adaptation research and provide new ways of looking at the subject through an integrated approach.

The findings of the study demonstrates a significant awareness on climate change among the literate youth population of Ghana and supports the findings by previous studies that climate change knowledge has grown steadily over the last three decades (Brechen, 2003; Moser, 2010). The study discovered that over 90% of the respondents have either heard of climate change or global warming, believe climate change is happening, have identified at least one factor as manifestation of climate change within their environments, think the phenomenon is already or will harm people with the next ten years, believe there is immediate need to take action to remedy the problem, think that both governments and individuals in Africa and elsewhere should act to avert the problem and regard the climate problem as serious. This observed significant awareness of climate change among the youth sharply contrasts the findings by the BBC (2009) even though readers must bear in mind that the subjects of this study were the literate youth who are exposed to various sources of information compared to the peasant farmers and traders who formed the majority of the subjects of BBC's study. However, limitations in climate knowledge were observed in the area of climate change causes where only 3% and 45% of the subjects attributed the cause of climate change in Africa to external factors (activities of industrial countries) and human activities respectively.

The findings of this study also show that a significant proportion of the respondents access and use the media regularly. About 80%, 73% and 52% of the subjects use television, radio, and Internet respectively at least two days a week. This means that the media can be an effective platform through which the youth can engage and be engaged on addressing the issues of climate change. This is even crucial when climate communication messages are aimed at promoting positive observational learning, outcome expectations or encouraging individuals in the contemplation stage to take action on desired behaviours (Bandura, 1986,

Ajzen, 1991). For instance, Prochaska and DiClemente (1993: 394) in a study observed that subjects in the contemplation stage of change "are most likely to respond to feedback and education as sources of information about smoking"

This study also provided a focused theoretical framework that brought together difference fields of research to explore their combined power to predict and explain climate change adaptation behaviour through the predicted model of social adaptation to climate change. The findings of this study especially the establishment of significant relationships between knowledge and cognition as well as between cognition and perceived adaptation behaviour provides strong support to the model and highlights the importance of this study in climate communication research. Bandura's (1986) social cognition theory postulates the power of self-efficacy in predicting behaviour and the positive role knowledge plays in that process whilst Ajzen's (1991: 188) theory of planned behaviour introduces another important element known as "*subjective norm*" "which refers to the perceived social pressure to perform or not to perform the behaviour". The discovery by this study that social and not individual cognition is significantly related to perceived adaptation behaviour mean that focused climate change messages can play important roles in promoting positive subjective norms by touching on the collective risks and responsibilities associated with the climate change challenge. Understanding the individual's stage in the change process can ensure that climate change messages are well targeted and relevant to the needs of the receiving audiences.

The results of this study show that media coverage of climate change has no significant relationship with public knowledge of the subject. This discovery can be explained from different perspectives. In the first instance, we can say that media coverage cannot be a useful variable for predicting public knowledge of the subject as the results tend to suggest. It can also be interpreted that the media has negative impact on public knowledge of climate change as previous studies tend to suggest in addition to the fact that the results of this study also established an inverse relationship between media coverage and climate knowledge (Corbett and Durfee, 2004; Moser, 2010; Carvalho, 2007; Wilson, 2002; Dirikx and Gelders, 2008; Nisbet, 2009). The third explanation which is preferred by the author is that this discovery could be due to the problem of measurement and of the methodology rather than the above interpretations. Limiting the measure of media coverage of climate change to only the subjects' perception of media effects and the fact that the questions were closed-ended meant that the measure could have been subject to many errors. A better option could have been to measure the variable through content analysis of media reporting on climate change in Ghana. The potential of the media to play significant role in promoting public knowledge and engagement with science has been documented from empirical research. Weingart, Engels,

and Pansegrau (2000) for instance, demonstrated how the German media within two decades (1975-1995) translated scientific hypothesis of climate change into certainties, thereby inviting public engagement and action on needed behaviour changes.

Among the most important findings of this study is that knowledge is significantly associated with human cognition. Aside providing strong evidence in support of the predicted model of social adaptation to climate change which formed the theoretical framework of this study, this discovery brings to light the importance of an aspect of climate communication research that has not been given attention by previous studies. Research on public knowledge of climate change to date has not made attempts to go beyond what has been observed about public knowledge, attitudes, etc. on the subject, to raise the question of what those observations mean for human cognition in the adaptation process (see Corbett and Durfee, 2004; Rabe and Borick, 2008; Leiserowitz, et al., 2010a; Brechen, 2003; BBC, 2009). Bandura (1989: 1175) notes that, "among the mechanisms of personal agency, none is more central or pervasive than people's beliefs about their capabilities to exercise control over events that affect their lives". In a similar vein, Grothmann and Patt (2005, 203) argues that 'if agents systematically underestimate their own ability to adapt, this qualifies as a more important bottleneck for adaptation than the objective physical, institutional and economic constraints'. The findings of this study therefore suggest that to achieve high human self-efficacy which is necessary for achieving positive climate change adaptation behaviour, research and practice on climate communication should first of all seek to improve public knowledge and understanding of the subject.

One equally important discovery of this study is that human cognition (social) is significantly related to perceived climate change adaptation behaviour. This discovery further strengthens the conceptual model of this study and highlights the importance of perceived self-efficacy in the climate adaptation process. As can be observed in table 4.6 above, both media coverage and climate knowledge were not found to have any significant relationship with perceived climate change adaptation behaviour. What this means is that climate researchers and policy makers need to understand that adaptation to climate change is a process and for an adaptation strategy to be successful, the key conditions of the process need to be satisfied. Media coverage ought to be directed towards building public knowledge, public knowledge should improve human cognition, and human cognition should improve adaptation behaviour. Seeking to break this chain by attempting to link media coverage or climate knowledge directly to climate adaptation behaviour may not produce the desired results. The fact that only social and not individual cognition have a significant relationship with perceived adaptation behaviour brings to light the importance of collective responsibility and

action in addressing the effects of climate change. Bandura's (2001: 14) conception of collective agency as *"Peoples shared belief in their collective power to produce desired results"* therefore play a significant role in advancing the project of addressing the effects of climate change if integrated into climate communication research and practice. This observation also underscores the fact that climate communication research and practice can benefit greatly through the understanding and application of Ajzen's (1991) concept of subjective norms which identifies the importance of social pressure in shaping behaviour.

Conclusion

This study has argued that comprehensive understanding and effective prediction of climate change adaptation behaviour can be enhanced by integrating key areas of research namely, behaviour change theories, media coverage and public knowledge of climate change into a single body of investigation where connected meanings can be made and combined influences of these areas explored. An equally important argument which has been implicit through the sections of this study is that climate research and policy need to recognise the role and importance of the human dimension to the climate change adaptation and mitigation process as much as the institutional and financial components.

This research project has made advances in both theoretical and empirical knowledge on the subject of climate communication and adaptation research. By conceptualising an integrative model that brings together hitherto fragmented wealth of research and knowledge into a single research project with an observed potential to foster better understanding of climate adaptation behaviour, this study has opened up new theoretical perspectives that can enhance future research in the field of climate research. The empirical findings of this study that helped to establish the high level of awareness of the subject of climate change among the survey participants, the establishment of the significant relationship between climate knowledge and human cognition, as well the establishment of significant relations between human cognition and perceived climate adaptation behaviour, are significant pointers to progress on empirical knowledge in the field. These findings support both the soundness and applicability of the theoretical framework of this study.

This study has implications for both policy and practice in the field of climate change communication and adaptation. The policy implication of this study is that climate adaptation policy initiatives need to recognise the importance of the human dimension (cognition and behaviour) as against the current focus on only economic and institutional

factors. This will mean taking climate talks from the conference rooms as is the case today, to the community grounds with the objective of showcasing that the subject of climate change is not only for the technocrats or the high level policy makers but that everyone can and need to be part of the process of seeking solutions to the challenge. Practically, the need to engage the public remains central but climate communicators need to understand that communication that intends to achieve behaviour change must recognise the role and significance of both knowledge and cognition in that process.

Further research can fill in the gaps that this research could not tackle due to its focus. One significant area is for future research to explore further the relationship between media coverage of climate change and public knowledge, a relationship that this study failed to establish. This can be done by employing methods that will allow for actual measure of media coverage and public knowledge of climate change. Moreover, this study focused on predicting perceived as against actual climate adaptation behaviour, leaving the gap for future research to explore how human cognition will impact on actual adaptation behaviour on climate change. Future studies can also explore further the link between individual cognition and climate adaptation behaviour as well as expanding the studies to cover other social classes of the population.

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