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THE INTERCONNECTION BETWEEN SCIENCE AND SOCIAL STUDIES CURRICULUM

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Abstract:
The purpose of this study was to see how well teacher trainees in selected Colleges of Education in Ghana would be helped to see both the differences between science and social studies, and the connections among them, using an action research design, including student interviews, observer logs, journal notes, students' 'connection' journals, student work, and record and planning book as data sources. The researchers designed and delivered an interdisciplinary science and social studies curriculum that focused on environment, water and energy. The sample comprised of 5,240 participants drawn from 3 Colleges of Education in the Central region of Ghana which were chosen by applying equal probability sampling technique. It was found that students were finally able to see the interdisciplinary nature of science, and social studies, as well as the connections between science and social studies. Implications include making explicit disciplinary instruction, as well as connections between the disciplines.

Keywords: science, social studies curriculum, Colleges of Education in Ghana

1. Introduction

There are national recommendations for students to understand how the disciplines are both connected, and different from each other (American Association for the Advancement of Science [AAAS], 1993; National Council of Teachers of Mathematics [NCTM], 1994). It is difficult to help students understand connections between disciplines unless they have an understanding of the nature of each discipline itself. There is also evidence that elementary teachers can increase the time spent on science if they

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successfully implement interdisciplinary instruction (Akerson & Flanigan, 2000). Given that the researchers was a college tutor that wants to spend time teaching social studies, they explored the opportunities an interdisciplinary approach would offer them in helping students understand connections between various disciplines and differences among them, while allowing them the time to teach social studies. Thus, the purpose of this study was to observe and document how successful the researchers, would be i Colleges of Education in the Central region in implementing an interdisciplinary approach to teaching science and social studies at the college level as evidenced by students' success in meeting content objectives and making connections between the disciplines.

1.1 Background

As teachers preparing to conduct our own research, we decided that an action research, or teacher research project would be appropriate for us in exploring methods for teaching science and social studies in an interdisciplinary fashion. As educators, we are mandated to constantly search for new ways to help students make sense of the multitude of life's experience and the bits and pieces of knowledge they gain from traditional departmentalized curriculum. Students today continue to move from one discipline to the next forcing the information to be disconnected to anything that resembles real life situations. To lighten some of the fragmentation in the knowledge to be acquired by students, and experience to be gained by teachers, holistic and integrated curriculums are being proposed and adopted by many school districts in the U.S which is a major driving force behind integrated teaching and learning. My definition of classroom-focused action research is when the classroom teachers conduct research on their own teaching or teaching situation. The teacher systematically identifies gab, designs a study, collects data, analyses the data, interprets and reports the results. The study can be used to inform teaching practice, and develops a reflective practitioner (Power, 1993). Schön (1983) recommends that practitioners in any field become reflective in order to be aware of and to improve their practice. The researchers wanted to become adept at reflecting on their own actions to better serve their college students. Adopting others' findings as far as research is concerned is beneficial, but not solely helpful at delineating practices that would work best for teachers. By using a teacher research approach the researchers are able to decide which approaches are best for their students and for themselves, and carefully track those approaches and their effects on students. Other teachers and educators have made similar improvements in their social studies teaching from using reflective teacher research (e.g. Dickinson et al, 1997). Indeed, several studies have pointed to the importance of action or teacher research in developing pre-service teachers' abilities to reflect on and improve their own teaching, particularly in the field of science and social studies (Scott, 1994; Fueyo & Neves, 1995; Stanulis & Jeffers, 1995). It was in the context of support from a university lecturers that the researchers endeavored to undertake an action research project to help themselves become reflective practitioners with the abilities to teach science and social studies in an interdisciplinary fashion with the help from colleague teachers from the science and Social Studies

departments of Foso, Komenda and Ola Colleges of Education. Interdisciplinary teaching, the concept of a core or integrated curriculum has been evolving throughout this century. One of the first and most significant studies on a core curriculum is the famous Eight Year Study of the Progressive Education Association (Aiken, 1942). The results of that study and nearly every study since then has documented that "*students in various types of integrative/interdisciplinary programs have performed as well or better on standardized achievement tests than students enrolled in the usual separate subjects*" (Vars, 1991b, p. 15). A holistic approach to teaching has gained popularity as supporting research is completed. Much discussion has been devoted in current educational circles to the notion of integrating curricular areas in order to foster a sense of the relationships among subjects and skills in the curriculum. It seems then that educators are realizing the potential of making meaningful relationships among learning areas in order for students to be more able to recognize the integrated way in which knowledge is used and viewed in the world. It also seems that educators are beginning to acknowledge that making connection with young people may actually reinforce skills and understanding more effectively than teaching in isolated content areas. Students who have the opportunity in schools to relate learning to real-life experiences, in their own lives and in the lives of their community and society, may be more capable of making new connections between previously learned material and new ideas (Jacob, 1989 The National Council for the Social Studies and the Social Science Education Consortium, for example, have sponsored activities and publications to bring about improvement in teaching and learning about science and technology as powerful shapers of our modern world. Other advocates of education about science and technology in society include the National Science Teachers Association, Carnegie Foundation for the Advancement of Teaching, American Association for the Advancement of Science, and the National Endowment for the Humanities (Hickman et al., 1987).

The National Council of Teachers of Mathematics (NCTM, 1995) issued a position statement that "*K-4 teaching should center on interdisciplinary instruction derived from a curriculum organized around questions, themes, problems, or projects to capitalize on the connections across content areas. Furthermore, children need curricula which are more authentic, that is, reflecting real life*" (p. 149). The Curriculum Task Force of the National Commission on Social Studies in the Schools (CTFNCSSS, 1989) stated "*to assist students to see the interrelationships among branches of knowledge, integration of other subject matter with social studies should be encouraged whenever possible*" (p. 3). The Benchmarks for Scientific Literacy (AAAS, 1993) support interdisciplinary instruction in that it recommends integrated curriculum planning, rather than parceling out plans to subject specialists. In addition, there is a recommendation for students to see the relationships among disciplines and to be able to differentiate between the disciplines. The third reason Benchmarks for Scientific Literacy supports interdisciplinary instruction is the recommendation that students' experiences add up to more than a collection of miscellaneous topics or 'fun' activities. These interdisciplinary ideas need to be meaningful and apply to the real world. There are several learning theories that support an interdisciplinary approach. In Frames of Mind: the theory of multiple intelligences, Howard Gardner (1985) proposes

that there are at least seven types of intelligence and that people can have more than one type of intelligence. He argues that education has focused primarily on linguistic and logical intelligences at the expense of the other five. Caine & Caine (1991) cite research showing that the brain learns best when it works to solve problems or accomplish specific tasks instead of simply memorizing small bits of separate facts. An interdisciplinary approach to instruction encourages such problem solving. Resnick & Klopfer (1989) states that people learn more successfully if they are asked to think in more complex ways and are given several ways to look at a problem. An interdisciplinary approach can address all these learning theories. As a result of the research supporting a connected curriculum, different approaches to implementing a connected curriculum have developed. In the researchers experience teaching college students, they observed that the more the students could connect the material being taught to information in their own lives, the more retention and comprehension they achieved Connecting the content seemed to be a crucial element of the lesson being successful. When the information being presented was more abstract and not related to the students on some personal level, the less interest they showed in the lesson, and the weaker their comprehension and recall was. It was also discovered that some disciplines were more difficult to fit into a theme and, as a result, some of the depth of the disciplines would be lost in a thematic unit and objectives would not be met for all disciplines. Currently the various programmes of a connected curriculum have been categorized into three basic approaches: integration, thematic and interdisciplinary.

These terms are defined by Lederman and Niess (1997) as follows: "*Integration refers to a combined or undivided whole where no clear distinction exists between the academic disciplines; thematic pertains to unifying or underlying commonalities among subjects or topics and tends to be broader in focus than integrated curricula; interdisciplinary maintains the integrity of the various academic disciplines, the distinctions between the disciplines remains clear, and connections between subject matters are emphasized*" (p. 57). The bulk of the research for an interdisciplinary approach is directed toward the middle school and high school years (Vars, 1991b). There is a strong movement in secondary education to incorporate interdisciplinary education, with much supporting research. Science instruction is particularly at risk here because teachers may get the idea that reading about science can take the place of actually doing science. While it is true that young children don't divide the world into boundaries, if as stated above, to make higher level connections between the disciplines one must first have knowledge of what comprises the identity of the disciplines, shouldn't we begin teaching the boundaries at the college level since that is the place of incubation of the whole enterprise of primary education? Integrated instruction removes the boundaries and makes it difficult to tell where one discipline leaves off and another one begins. It is based on this notion that the researchers decided to implement an interdisciplinary approach at the college level, focusing on 3 themes, but still having distinctions between the disciplines. As stated above, the researchers found integrated instruction to be limiting, particularly in the areas of math and science. As a result of their teaching experiences combined with their Post graduate course work, the researchers became interested to learn if there was another possibility besides the

thematic approach at the college level for successful integration of the disciplines that would not lose the nature of the disciplines. Research has shown that an interdisciplinary approach is beneficial for students reading below grade level (Gaskins & Guthrie, 1994) and gifted students (Vars & Rakow, 1992), as well as the average student. There is also strong research that suggests connecting reading and writing to the sciences and social sciences. "*Merging these domains of science, history and literature can enable students to learn content and process simultaneously and create an intrinsically interesting context for teaching the cognitive and metacognitive aspects of reading and writing*" (Gaskins & Guthrie, 1994, p. 1039). The study is guided by the following research questions;

1. What are the connections between Science and Social Studies as disciplines?
2. How would students be able to recognize the individual disciplines and the skills and tools used for the particular disciplines?
3. What strategies and approaches should propel interdisciplinary instructions in the classroom?
4. How successful would students be at meeting the objectives for each discipline as evidenced by their performance?

3. Literature Review

> "*Social Studies teachers often teach in isolation from the other content areas, but cross-curricular content helps students see the connection between class work and their everyday lives. Science and Social Studies content often overlaps; for instance, when addressing standards around human impact on the environment or the impact of weather patterns and geological events on people. How do governments and people prepare for these events? How does policy affect our planet? How can drought lead to conflict? The possibilities are endless Social Studies instruction should challenge students to think about the events that have made our world the way it is: the lessons should be so engaging and interactive that no child could ever find it boring…"* (Patrick, 2007).

A current trend in Social Studies education is concern about the relationships of science and technology to human societies in the past and present. The National Council for Social Studies and the Social Science Education Consortium, for example, have sponsored activities and publications to bring about improvement in teaching and learning about science and technology as powerful shapers of our modern world. Other advocates of education about science and technology in society include the National Science Teachers Association, Carnegie Foundation for the Advancement of Teaching, American Association for the Advancement of Science and the National Endowment for the Humanities. Given the advocacy of national leaders, there appears to be a movement to infuse science- and technology-related topics and issues into the curricula of elementary and secondary schools. There is little evidence however, of widespread classroom adoption of content about science/technology/society Education on STS involves, first of all, consideration of the various interactions of science and technology in a social context. Science and technology affect and are affected by the institutions and

values of a society. The following examples of major STS themes suggest the compatibility of teaching and learning about science/technology/society with education in the Social Studies (Bybee, Faith, Hackman & Patrick, 2006)

Societies of our modern world are increasingly propelled and changed by advances in science and technology, which generate critical public issues. These issues pertain to such matters as the technical efficiency and public safety of nuclear power plants, the hazards of recombinant DNA research and genetic engineering, and the perils posed by modern weapons. A study by Bybee et al., (2006) indicates that science educators perceive the most important STS problem in our world to be world-wide hunger, unchecked population growth, declining air quality, depletion of water resources, and the destructive capacity of modern weapons systems (STS). The processes and skills in thinking about critical public issues associated with Science and Technology. Education about STS issues involves development of higher-order cognitive abilities associated with processes of decision making, problem solving, and critical thinking. Students who confront science- and technology-related social issues have opportunities to inquire about alternatives and their consequences in the process of making rational and defensible choices.

The utility of trade-offs in decision making on STS Issues. Public issues anchored in scientific and technological applications to society often involve trade-offs between conflicting values in which there is no clear view of right or wrong. Many environmental issues, for example, may involve a compromise or trade-off among conflicting value positions (e.g., limiting pollution sufficiently to protect health and environment while still maintaining a satisfactory level of production and employment). Students are required to think in terms of "more" or "less" of one thing or another instead of making an uncompromising choice of "either" one thing "or" another (Baybee et al., 2006).

The emphasis here is on an individual's capability and willingness to participate in civic decision making about STS issues and to act upon these decisions. Opportunities are provided for testing proposed actions through civic participation. While simulations and role-play activities are included in most STS units of instruction, there is also the need for civic action projects that are consistent with school rules and regulations. STS issues cut across disciplinary boundaries, such as Biology, Geology, Geography, History, and Political Science. Students and teachers are required to flexibly apply content from various subjects to inquire about issues and make warranted choices in responses to them.

Ability to connect information and ideas within and between academic disciplines and to link different fields of knowledge is a key to high-level understanding of social reality. Education for responsible and competent citizenship in an increasingly complex technological society requires that students be able to synthesize and apply knowledge from many disciplines. Every discipline in the Social Studies can be basically connected to content on science and technology in society. To ignore this reality will limit students' abilities to comprehend their world and to act effectively within it. Thus, content on STS must be connected to the study of Geography, Economics, Political Science, History, and other subjects in the Social Studies curriculum to help students make connections among

facts and ideas needed for responsible citizenship in today's world. Furthermore, content on STS in the Social Studies curriculum can and should be connected to education on science/technology/society in the Science curriculum (Bybee et al., 2006).

The survival of Ghana in relation to the training of efficient and qualified scientific citizens through the school system depends not only upon the educational policy decisions that were taken lately, but also upon the measures in which the teachers can effectively achieve profound and necessary curricular reforms. That implies a pragmatic orientation of the curriculum, a connection to the problems of the contemporary society, an educational paradigm change and a flexible pedagogical conception, dissociated from the principles of the traditional, conservatory and out-dated pedagogy. In this context, the curriculum integrated approach, the alignment with the competences represent - both for the conceivers of educational policy, of scholar curriculum etc., and for the education practitioners - the reference that can move the school out of its old patterns /routine (Draghicescu, et al., 2014).

Perception is the result of one's attitude. For example, two people with different perceptions look at the same thing and thus think about it differently and end up with different attitudes. By which they all think they are right. According to Adediwura & Tayo (2007), attitude could be defined as a consistent tendency to react in a particular style often positively or negatively toward any matter. Attitude possesses both cognitive and emotional components. Fazio and Roskes (as cited in Davis, 2010) attitudes are important to educational psychology because they strongly influence social thought, the way an individual thinks about and process social information. Eggen & Kauchak (2001) opined that positive teachers' attitudes are fundamental to effective teaching. The teacher must work students into such a state of interest about what the teacher is going to teach the students so that every other object of interest is banished from the students' mind. The teacher should also fill the students with devouring curiosity to know what the next steps in connection with the topic are.

A study conducted by McQuitty (2016) on perception of Science teachers regarding the integration of Science into the Social Studies education curriculum has revealed that many Science teachers hold positive attitudes toward the integration of Science into the Social Studies education curriculum. Many Science teachers believe that Social Studies plays a big role in Science. Scientists are historical figures, and their contributions are significant to Science in many ways; for example, astronomers who discovered how the earth fits into our solar system and Thomas Edison many inventions that advanced both science and humanity. Geography and the study of natural resources and land forms are closely tied and can be taught together as well. Science holds many possibilities for learning Social Studies. He recommended that Social Studies must be the easiest subject to integrate since it pertains to practically everything that we do in life. Some of the important aspects in Social Studies do, in fact tie in with other subjects well, but some topics are taught better when the focus can be solely on that topic.

4. Methodology

For this study, the researchers implemented an interdisciplinary approach, with the focus on connecting science and social studies. It was the researchers' goal to define the boundaries of the disciplines while showing the content connections between the disciplines. The study was guided by the following research questions;

1. What are the connections between Science and Social Studies as disciplines?
2. How would students be able to recognize the individual disciplines and the skills and tools used for the particular disciplines?
3. What strategies and approaches should propel interdisciplinary instructions in the classroom?
4. How successful would students be at meeting the objectives for each discipline as evidenced by their performance?

The survey was conducted on 30 college tutors and 120 teacher trainees of Colleges of Education in the Central Region, thus Ola, Komenda and Foso. In administering the questionnaire, a letter of introduction was taken to all the Colleges of Education mentioned. This letter was sent to the selected Colleges of Education for permission in order to enable the researcher to have easy access to the Social Studies and Science tutors as well as the teacher trainees within the colleges. The selected teachers were informed of the purpose of the study as well as their anonymity and confidentially were assured. The collection of data through the observation was done by the use of report writing where information from the observation was written verbatim in summary or in key words. Semi-structured interviews in which the questions were not fully predetermined were employed as the third instrument. The questions were strictly based on the questionnaire. The semi-structured interview schedule made room for adjustments as the need arises.

According to Harding (2013), if a relationship has been developed between the researcher and participants, the interviews are more apt to provide useful data. The results from the interview for tutors on instructional content, methodology and pedagogical strategies designed to improve student understanding of concepts as well as students interviews on methodological and pedagogical strategies employed for instruction and their impact on understanding of concepts were transcribed verbatim and coded based on Harding (2013) constant comparative method. The purpose was to determine the perception of tutors on the integration of Social Studies with the teaching of Science in the Colleges of Education and the factors that might hinder the use of integration among college tutors. The data collection exercise started on 1st April to 31st May, 2019. Thus, the data collection exercise lasted for a period of two months. The said data was collected by the researchers with the help of other two trained assistants sequentially. Some of the challenges encountered by the researchers included delay on the part of tutors to complete the questionnaires as well as the lack of commitment on the part of the tutors for the observational studies.

The subjects involved in my project were the 120 (80 girls and 40boys) students teachers, their assigned teachers numbered 30 in all from the three selected colleges

(subject Specialists with 10-20 years of teaching experience in science and social studies . The student population was drawn from three main colleges in the central region of Ghana which was considered diverse and challenging. This is because, in terms of population, these colleges almost have the same intake as its leadership work based on directives (quota system) from government. However, the composition of male to females in the mixed sex institutions may differ depending on course structure as well as availability of accommodation facilities in these colleges.

In other to implement the project the researchers needed to develop the interdisciplinary curriculum. The researcher obtained the curriculum for social studies and science from April to May, 2019 with the understanding that the researchers develop connections as there may be. The researchers developed a curriculum that consisted of a combined unit in social studies and science on units on environment, energy and water as concepts that runs through science and social studies curriculum for the second semester in first year. The emphasis was on an interdisciplinary curriculum which left the boundaries of the various subjects intact, while demonstrating the connections between the subjects. There was no central theme for integration, but, there were connections between the disciplines or subjects, leaving parts of the disciplines purely to the subject itself. It was determined that the interdisciplinary lessons would be planned and taught by both social studies and science teachers in the colleges for the 8 weeks. The connected curriculum designed by the collaborative efforts of teachers of social studies and science was implemented during the stipulated time. Due to the design of the classes, the environment unit was taught first followed by units in energy and water. With the help of the other team members from science and colleagues from social studies unit, we implemented the interdisciplinary curriculum in the 8 weeks. In addition to the curriculum, a classroom group discussion on the nature of science and social studies was conducted every Friday in the respective class. A KWL chart was used for the discussions that the students copied down in their journals. The chart was referred to throughout the project and updated every week. To ensure the validity of my qualitative research, the researchers collected data from a variety of sources as identified and defined below. They designed the collection and analysis methods from McNiff, Lomax & Whilehead (1996). These different sources were used to triangulate the results, allowing the researchers to find common themes throughout the data and to draw valid conclusions.

Interview with Subject Specialist: This interview disclosed what instruction method the students have been exposed to. A semi-structured interview was adopted as it gives the researcher the opportunity to probe further into the discussion. This is because; the semi- structured interview has no restrictions in the wording of the question, the order of question or the interview schedule. The interviewers have the discretion to form questions on the spot, probe into issues and in some cases follow the order dictated by the situation. These also served as an avenue for discussion as well as a follow up for the questions. The semi-structured interview items were constructed in line with the research questions thus, it captured research questions one; What is the connections between Science and Social Studies as disciplines? What strategies and approaches must drive home interdisciplinary instructions in the classroom? How would students be able

to recognize the individual disciplines and the skills and tools used for the particular disciplines? How successful would students be at meeting the objectives for each discipline as evidenced by their performance?

The items for semi-structured interview sessions were administered on the same selected tutors who took part in the observation lessons and 30% of the student population for the observation study. This was based on the recommendations of Kumar 2005. Kumar (2005) averred that with a population of 100 and above, 10-30% could be selected for the study. The intention of the researcher was to unify the curriculum hence it was to diagnose whether students saw any connections and real life application among the disciplines.

The researchers kept a daily observer log noting the reactions and behaviour of the students who were interviewed. The researchers were looking for behaviour that represented the students meeting objectives and making connections between the disciplines. Tutors engaged in the observation study were made also to keep a journal of each day's events, noting their own performance and behaviour engaged in this project. Students kept journals in which they reflected on a weekly basis of any connections they saw between the content areas introduced that week. The journals were kept in the classroom and reviewed them at the end of each week. They served as evidence of students meeting content objectives and making any connections between or among weeks. The students were asked to use any form of written communication (narrative, lists, outline, and illustrations) to demonstrate the connections to other content areas or to real world applications. An example of a real-life connection was a student recognizing that a crane at a recycling centre used a huge electromagnet to collect scrap metal and noting that observation in his connection journal. The researchers were also looking to see what impact the interdisciplinary curriculum had on their interest in the content being taught, in the development of their knowledge of the subjects of social studies and science and their success at mastering the content introduced in the interdisciplinary lessons.

As many as 60 students in the class representing (50%) were able to make a connection between science and social studies at the beginning of the study and as the students' exposure to the nature of the disciplines increased, so did their ability to make connections between the two subjects also advanced. Hence after the intervention lessons, as many as 106 representing 88 % saw the interconnections.

The third trend noted was that all data directed towards the students' performance in meeting the objectives indicated that when the students' interest was high in the content being taught and the real-life applications were more evident and again, an interdisciplinary curriculum could strengthen the knowledge of the disciplines themselves by keeping the boundaries of the subjects intact, while at the same time presenting the connections between all disciplines, and consequently taking those connections and applying them to practical real-life circumstances.

Performance of students evidenced a growth in the understanding of the nature of the two subjects: science and social studies. The students demonstrated an improved baseline of knowledge about the substance of the two subjects. This was evidenced by

students' responses in their test. Immediately after the observation study, the students who took part in the observation lessons were tested with the test items administered before the observation.

The results from the pre-test and post-test are indicated on Table 1 and 2 respectively.

Table 1: Pre-Test Results

Marks	Frequency	Percentage (%)
1-2	4	3
3-4	3	2
5-6	40	33
7-8	60	51
9-10	13	11
Total	120	100

From Table 1, the performance of the students before the observation study was good generally, as many as 16 out of the forty students' constituting 40% percent of the students' population for the study scored between 9-10 marks. However, the students' performance was amazing after the observational study. Table 14 better illustrates that.

Table 2: Post-Test Results

Marks	Frequency	Percentage (%)
1-2	-	-
3-4	-	-
5-6	30	30
7-8	40	20
9-10	50	50
Total	120	100

The Table 2 depicts improvement in students' performance after the observational study, with as much as 20 students scoring between 9-10 marks respectively. The said students were also interviewed on their thoughts and feelings about how the interdisciplinary instruction was beneficial to both content areas. The results from the test indicated improvement in students' overall orientation as far as the topics were concerned. The said test items constitute Appendix c. The researcher conducted and transcribed all interviews.

As many as the sixty students had more accurate information to contribute regarding the subjects in the post-test, though their definitions were still a little shaky. While there are still obvious misconceptions evident in the responses, it is my assumption that this increase in knowledge was correlated to the explicit group discussions every week on the definition and nature of the three disciplines. This element of the project was added when I realised how limited the students' knowledge was in the basic subjects. As the students' knowledge of the disciplines grew with our class discussions, so did their capacity to make connections between the disciplines and also their ability to make real-life connections to the curriculum. Some examples of real life connection comments are:

Electricity as a form of kinetic energy helps us today, whereas dead people in history had a much harder time without electricity. Without water, there would not be any electricity, and we would have to use candles to see, and we wouldn't have things like computers and TV. Life would be harder, and different. Thomas Edison's invention of the light bulb was very important for the world and made our lives a lot better, but you still have to be careful with electricity! This was an interesting development that also supported research on an interdisciplinary curriculum. The Daily Observer Logs and Reflection Journal notes helped to support the trends during the research. Nearly all of the notations from the Daily Observer Logs and the Reflection Journal notes indicated a weak background knowledge in the nature of the disciplines, and that very few connections were being made by the students or real-life applications to the content being taught.

5. Conclusions

This research is to support existing research on interdisciplinary curriculum that students need a strong foundation in the nature of the various disciplines or subjects before conceptual connections between the disciplines and the resulting real-life applications can be made. Again, the results from the pre-test and post-test confirm what several writers reported that students in schools focus on and take part in integrated curriculum perform better on standardized tests and state exams than students in schools that do not (Libler, Schlee and Shriner, 2010; Campbell & Henning, 2010; Hinde, Osborn, & Dorn, 2007). Harrell (2010), reports that integrating curriculum enhances students learning. The majority of the students did not take an active part in their learning and were constantly looking for guidance and directions from the researchers in their learning process. It was an interesting observation that the more interest the students had in a unit, more they were willing to work independently.

Some of these behaviour patterns could be attributed to several factors: that these students had very little exposure to cooperative learning, the dynamics of the personalities of the students and having new teachers. Implication of this is that study of this nature requires the constructivism theory of instruction as the paradigm. Constructionism advocates student-centered, discovery learning where students use information, they already know to acquire more knowledge (Alesandrini & Larson, 2002). An approach to learning based on the constructivist learning ideologies presented by Jean Piaget (Harel & Papert, 1991). In his approach, the individual is consciously engaged in the construction of a product (Li, Cheng, & Liu, 2013). The utilization of constructionism in educational settings has been shown to promote higher order thinking skills such as problem-solving and critical thinking. Constructionist learning involves students drawing their own conclusions through creative experimentation and the making of social objects. The constructionist teacher takes on a meditational role rather than adopting an instructional role. The teacher's role is not to be a lecturer but a facilitator who coaches students to attaining their own goals (Alexandrini & Larson, 2002).

The researchers therefore conclude that implementing an interdisciplinary curriculum is challenging, but important task. From the research an interdisciplinary curriculum could be implemented successfully, but it should be started at the beginning of the school year, with an emphasis on building a foundation of knowledge on the nature of the disciplines.

In dealing with interdisciplinary instruction of any kind, the emphasis must be on interdisciplinary curriculum, the boundaries of the various subjects ought to be left intact, thus, leaving parts of the disciplines purely to the subject itself, while demonstrating the connections between the subjects.

6. Recommendations

Interdisciplinary instruction of any kind requires student centered learning strategies such as cooperative learning, guided instructions, experiential learning as well as the problem-based learning.

With the curriculum reform that is being currently undertaken in Ghana, an interdisciplinary curriculum should be considered an important part of that reform because, just simply teaching different disciplines is not enough for students to recognise differences between and connections among the disciplines.

Due to the bottleneck associated with implementing interdisciplinary instructions in the classroom, stakeholders of education must make it a point to encourage educators to endeavor to work on it.

In other to drive home good interdisciplinary instruction of any kind in the classroom, means to propel the process to be there, hence good teaching strategies and approaches should be enforced.

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Appendix A

Foso College of Education
Arts and Social Sciences Department
Social Studies Unit
Semi-Structured Interview Questions for College Students

Introduction
The following questions are to determine the level of students' understanding with respect to the interdisciplinary approach to teaching and learning in the classroom after the observation lessons. You are kindly requested to respond to each item on the semi-structured interview as candidly as you can.

1. What topics in your specialized area of study have links with other disciplines?
2. What links did you establish between the subject areas you just learnt?
3. What aspect of the integrated unit engaged and inspired you a student?
4. How effectively did the teacher incorporate academic contents from the two subjects' areas?
5. How did the integrated instruction impact on your socialization skills?
6. How effectively did you make connections and meaningful transfers between the two disciplines?
7. What differently do you expect to see next time such approach is used to teach?
8. What ideas and suggestions do you have for improving the integration of social studies and science?
9. How did the integrated topic enhance your learning?
10. What recommendations will you give regarding the integration of disciplines?
11. Would you recommend the use of integrated curriculum in Ghana?

Thank you

Appendix B

Foso College of Education
Arts and Social Sciences Department
Social Studies Unit

Introduction
The following questions are meant to determine the level of student assimilation with respect to the three topics used for the observation lessons before and after. Thus, the topics were Energy, water and Ecosystem.

Pre – Test Questions

1. Name two environmental implications of using solar and Biomass as energy sources.
2. How does fossil fuel affect the environment?
3. Mention and explain two ways global warming can be reduced with environment as the focus.

4. A biotic community is any naturally occurring groups of different organisms living together and interacting in the same environment. True/False.
5. List two importance of wildlife to the environment.
6. List 5 sources of water.
7. Where does the energy for the water cycle come from?
8. An electric drill changes electrical energy into ……
9. Food is an example of …….energy
10. When water vapour becomes liquid water, the process is known as ……
11. State two chemical properties of hard water.
12. How is distillation different from frictional distillation?
13. Which of the form of purification of water will you recommend for your community and why?
14. Does the lime becomes potential and kinetic energy.
15. Briefly explain two importance of water to man.