American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS)
ISSN (Print) 2313-4410, ISSN (Online) 2313-4402

http://asrjetsjournal.org/

Infusing Competencies and Skills of Vocational Instructors: Innovations to Boost Science and Technology for National Development

Clement Ayarebilla Ali[a*], Peter Akayuure[b]

[a]*Department of Basic Education, University of Education, Winneba, P.O. Box 25, Winneba*
[b]*Department of Mathematics Education, University of Education, Winneba*
[a]*Email: ayarebilla@yahoo.com*
[b]*Email: akayuure@yahoo.com*

Abstract

The study explored how teacher-training institutions could infuse the Community Development Vocational and Technical Institutes' instructors with educational competencies and skills as innovations to boost science and technology to accelerate national development. Even though the restructuring transformed the then Women Vocational Training Institutes into Community Development Vocational and Technical Institutes, and subsequently introduced Core Mathematics, it was still not clear whether the instructors had the required competencies and skills to implement the curriculum. This exploratory survey purposively sampled fifty instructors in three districts of Upper East Region and issued with questionnaires to explore the instructors' educational and Mathematics backgrounds. Having coded and analysed the data with SPSS software, the findings showed that the educational and mathematical backgrounds of the instructors still require further education and training in the competencies and skills. This would build skilled manpower, create jobs, reduce north-south migration and accelerate national development. We therefore, recommended continuous inter-tertiary collaborations, scholarships and realignment of the CDVTI institutes to the Ghana Education Service to achieve these goals.

***Keywords*:** innovations; national development; competencies and skills; science and technology.

---

* Corresponding author.

1. Introduction

Competencies and skills can be used interchangeably. In fact, some skills are also competencies. However, while competencies are explained as the effective application of skills, skills are the natural and learned capacities to perform acts. Generally, competencies and skills are the measurable or observable knowledge, skills, abilities, and behaviours (KSABs) critical to successful job performance. These allow employers to plan, recruit, manage, train and develop employees effectively as observed by [1, 2, 3, 4, 5].

In education, the necessary competencies and skills are knowledge (practical and theoretical understanding of subjects), skills and abilities (natural and learned capacities to perform acts) and behavioural (patterns of action or conduct). The basic required competencies and skills are teaching, subject matter, pedagogical, professional and curriculum. These competencies and skills are normally measured by levels of education, academic attainments, kinds of certificates and types of subject(s) offered [6, 3].

1.1 The concept of Educational Innovations

Innovation is the process of translating an idea or invention into a good or service that creates value. Here, the idea must be replicable at an economical cost and must satisfy a specific need. In this context, innovation helps create new methods and joint venturing between the teaching tertiary institutions and CDVTI institutes [2, 9].

Innovations are divided into evolutionary innovations (continuous or dynamic that are brought about by advances in technology) and revolutionary innovations (discontinuous innovations which are often disruptive and new). Therefore, educational innovations are the methods of imbibing new educational paradigms to existing strategies in science and technology. These are normally new technologies, services, solutions and experiences. The rests are processes, methods, outcomes and social good [10, 8, 11, 12].

1.2 Areas of Science, Mathematics and Technology

According to [11], science, mathematics and technology refer to the physical, biological, and agricultural sciences; computer and information sciences; engineering and engineering technologies; and mathematics. In this study, therefore, the competencies and skills of instructors as innovations for science and technology for national development refers to imbibing new educational paradigms to the teaching methods and strategies for vocational instructors in science, technology, and mathematics.

The rapid and unprecedented competition of the global economy in recent decades has sped up the role of science, technology and innovation (STI) strategies for national developments. This has compelled many states and state institutions to play critical roles in promoting science and technology, as innovation requires a level of investment not easily derived from either the individuals or the private sector. The competitions between continents have also compelled many industrialized countries to move away from heavy industry in favour of nanotechnology, biotechnology and alternative energy solutions [10, 8, 13].

Also, STI have emerged as the major drivers of national development globally. As countries aspire for faster,

sustainable and inclusive growth, the STI play crucial role in achieving national goals and become central to national developments [14, 15, 8, 16]. [17] contends that there are many infusing issues that need to be tackled simultaneously in this post-2015 development agenda to ensure that innovation driven growth is no longer the prerogative of high income countries alone, and Ghana must take a look at to accelerate her economic growth.

1.3 Ways of Infusing Competencies and Skills in UN Member States

The United Nations enjoin countries to foster STI policy innovations, incorporate science and technology education in all school curricula, partner with universities to return skilled labour, broaden culture of STI and make STI accessible to all people. This is because STI is essential to a knowledge-driven economy, and the capacity to infuse new education into all facets of education to creatively develop very competent and highly skilled instructors is fundamental to Ghana's development [7, 8, 18].

Similarly, [7] and [19] contend that to realise the full potential of STI to support sustainable socio-economic growth and development, and improve African competitiveness in the global arena, require states continue to expand the quality education at all levels. To achieve this goal, states must take a systematic and coordinated approach to human capital development and popularise STI research and innovation. This would curb brain drain so that the limited means of the continent are not transformed to investment in other continents. This ensures that the continental intellectual capacity can be effectively harnessed to drive Africa's socio-economic development.

[19] adds that measuring Africa's impact is based on the number of Africans trained in STI. In doing this, [10], [7], and [18] recommend resourcing managements, providing skills training and improving working conditions. It is therefore, important that we explore educational methodologies as ways of boosting competencies and skills in teaching the STI domains towards the avowed goal of attaining accelerated national development.

1.4 Ways of Infusing Competencies and Skills in Ghana

[20] bemoans the abysmally low rating and priority accorded the demand for STI in Ghana in the eyes of policy makers and industries. This has resulted in inadequate allocation of budget to STI sub-sectors. It has even been argued that the failure of industries to engage the talented and skilful young men and women who opt for STI programmes, have swayed them to pursue medicine and other related health sciences to the neglect of STI careers [21, 8].

[21] agree that STI research, teaching and learning is a dynamic process. And even though the old routine ways of teaching are still essential, Ghana needs multiple ways of theory, practicals and methodologies to demonstrate high levels of competencies and skills of instructors. [22] and [20] contend, among other things, that the Ghana's STI draft policy was to promote competition, create job opportunities, industrialize, and enhance innovation. However, [6] discovered that competencies and skills of the vocational students fell short to achieving these goals. Teacher-training institutes therefore, need to infuse educational methodologies into the instructors to help propel science, technology and innovation into higher pedestals to accelerate our quest for national development.

1.5 Ways of Boosting Educational Competencies and Skills

The major boost to STI is to increase the number of individuals pursuing STI careers. This will increase the number of competent and skilled people with STI certificates, diplomas and degrees in a wide array of related disciplines requiring critical thinking, new inventions and innovations strategies [(21, 7, 23, 24]. [25] and [9] support that the individuals need to develop their cognitive, non-cognitive and technical dimensions. The four cognitive skills are core subjects or 3Rs (basic literacy, numeracy, and global awareness/health literacy), life and career skills (productivity, accountability, leadership and responsibility), learning and innovation skills (critical thinking, communication, collaboration, creativity), and information, media and technology skills.

1.6 Statement of the Problem

The researchers presented a conference paper on the challenges of vocational students and observed that many students had no adequate mathematical backgrounds to continue their education to the tertiary levels and/or compete with senior high students in the labour market. We traced the source of challenge to the methods and strategies used by instructors in the vocational education sub-sector and wish to explore the mathematical competencies and skills of instructors of Community Development Vocational and Technical Institutes (CDVTI) in Upper East Region of Ghana [6, 26].

The exploratory pre-survey of three CDVTI institutes of the Upper East Region of Ghana suggests that most instructors of the CDVTI sector rarely implore educational methodologies in the teaching and learning processes. The only commonest strategies they all seemed to be familiar with were practical sessions. Even in applying these practicals, a lot of loopholes in dealing mathematical problems cropped up. One of such loopholes was gathering, computing and analysing experimental results obtained from the quasi-mathematics topics in cookery, block laying, sewing and carpentry. Instructors of applied mathematical concepts were not spared these criticisms. Appropriate competencies and skills were rarely exhibited in accounting, book keeping, computing and statistics. These lacked of competencies and skills could bring dire consequences to the students and impact negatively in national development.

It was also observed that the students resorted to rote learning of mathematical relationships to solve these mathematical problems in situations where few instructors made efforts to imbibe moderate competencies and skills into the teaching and learning processes. The results of the students' performance attested to this fact, and suggested that a lot more of these competencies and skills are still needed to consolidate relational understanding.

The newly introduced mathematics syllabus for the CDVTI embodied Algebra, Statistics and Geometry, all of which require varied and appropriate methodologies to facilitate and consolidate meaningful learning. But this was likely unachievable, due to the differences in teaching, subject matter, pedagogical, professional and curriculum methodologies of instructors. The study therefore, sought to explore how teacher-training institutions could infuse competencies and skills of the CDVTI instructors with these educational methodologies to boost science and technology for accelerated national development.

The study therefore explored how teacher-training institutions could infuse educational methodologies to CDVTI instructors to boost competencies and skills to enhance the quality of teaching and learning in order to propel science and technology for national development. The specific objectives were:

- To explore the effects of instructors' educational and Mathematics backgrounds on their competencies and skills in implementing the mathematics curriculum.
- To suggest policies directions to help infuse educational methodologies to uplift and upgrade the competencies and skills of CDVTI instructors.

3. Materials and Methods

The researchers obtained an informed consent and assent permissions from the CDVTI institutes through their heads and representatives before collecting this data to grant the ethical approval for this study. Permission to issue the questionnaire for the research in the selected institutes was also obtained from each and every instructor, with assurances of confidentiality and anonymity of their responses.

The resign design was primarily exploratory and sought to explore the educational and mathematical backgrounds could explain the five basic competencies and skills of CDVTI instructors. The anticipated number of instructors was one hundred (100) but only fifty (50) of them were readily available and purposively sampled to represent the population. The independents variables were the educational and mathematics backgrounds and that of the dependent variables were the competencies and skills of teaching, subject matter, pedagogy, professional and curriculum. These segmentations adequately explained the effects of educational and mathematical backgrounds to the competencies and skills.

The tools of data collections were questionnaires. The questionnaires were divided into educational backgrounds, mathematical backgrounds and competencies and skills. While the educational and mathematical backgrounds were open-ended, the competencies and skills were given three-point coding scales. These allowed us to solicit more information about the instructors' educational and mathematical backgrounds while maintaining our focus on the required competencies and skills. Having collected the data, the SPSS software was used to produce and analyse the data with bar charts, pie charts, Spearman's correlation coefficients and chi-square tests. The bar charts explored the educational backgrounds, the pie charts explored the mathematical competencies and skills, the correlation coefficients and chi-square statistics assessed the effects and tests of the groups' differences respectively.

4. Results

The figure 1 above shows the age ranges of the CDVTI instructors of Upper East Region of Ghana as at June, 2015. It was observed that the majority of the instructors aged between 25 to 29 years. The ranges of 30 to 34, 35 to 39 and, 40 years and above followed closely in that order. These relatively youthful ages of the instructors serve as strong arguments for training them the art and science of teaching and learning in the institutes. It also means government and other stakeholders would gain from investing in heir education and training, since this category of workforce have long number of years to retire from active service. Furthermore, the youthful ages

means that many of them can cope with the studies of Mathematics at higher levels should they be granted opportunities for further studies. Policy makers would therefore, find it easier to introduce the policy of acquiring mathematical competencies and skills for the instructors to enrich their teaching and research.

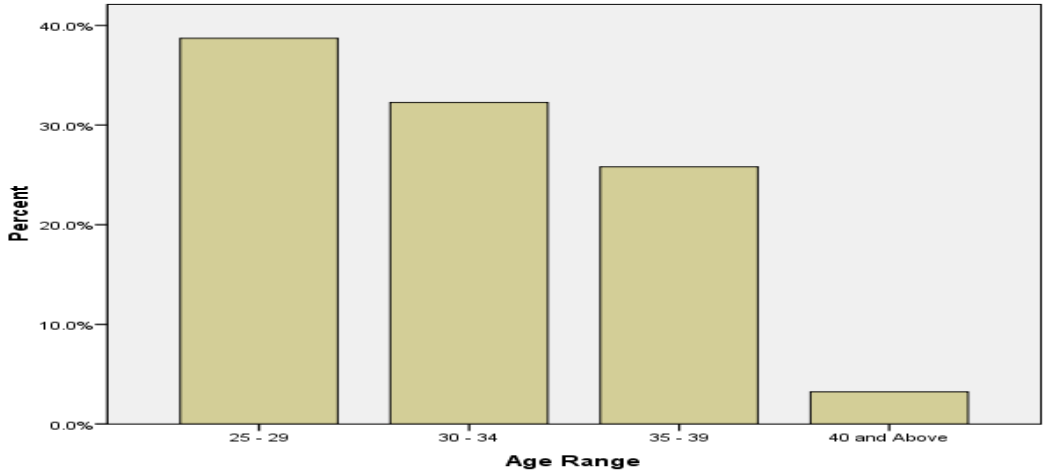

Figure 1: Age Ranges of CDVTI Instructors

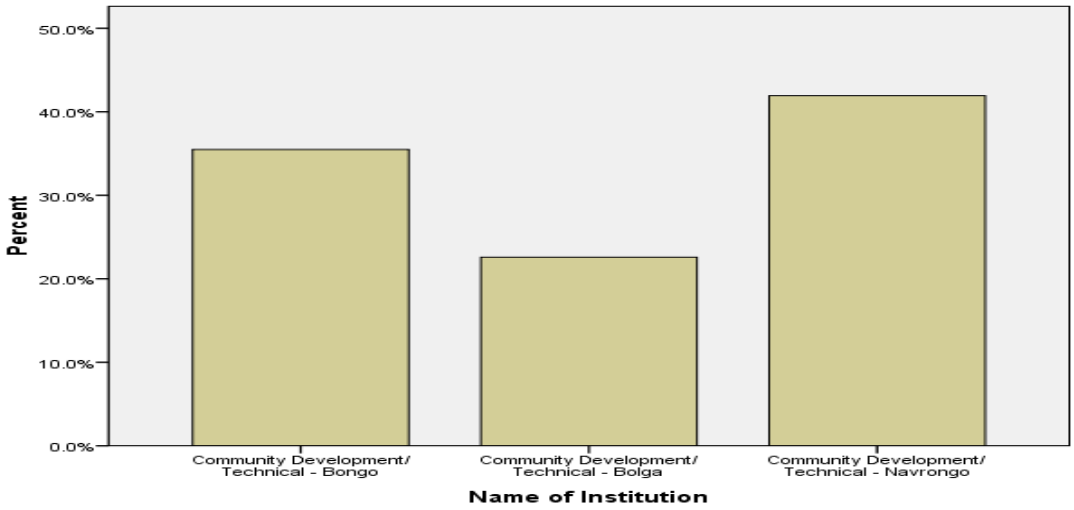

Figure 2: Name of CDVTI Institutes

The figure 2 above shows the three CDVTI institutes in the Upper East Region that were studied. We revealed that majority of the instructors came from Navrongo CDTVI. Bongo followed second and Bolgatanga became third. These higher enrolments of instructors in relatively rural districts suggest that rural communities have embraced the concept of CDVTI education and training as compared to their urban districts. This means that the CDTVI system, if well enhanced, equipped and coordinated, would create jobs, reduce north-south migration and accelerate rural enterprises development. Also, training the instructors would impact positively on their

graduates, and, in the long run, produce competent and skilled rural personnel who would spearhead the development of rural Ghana in the STI domains, and help accelerate the overall national development.

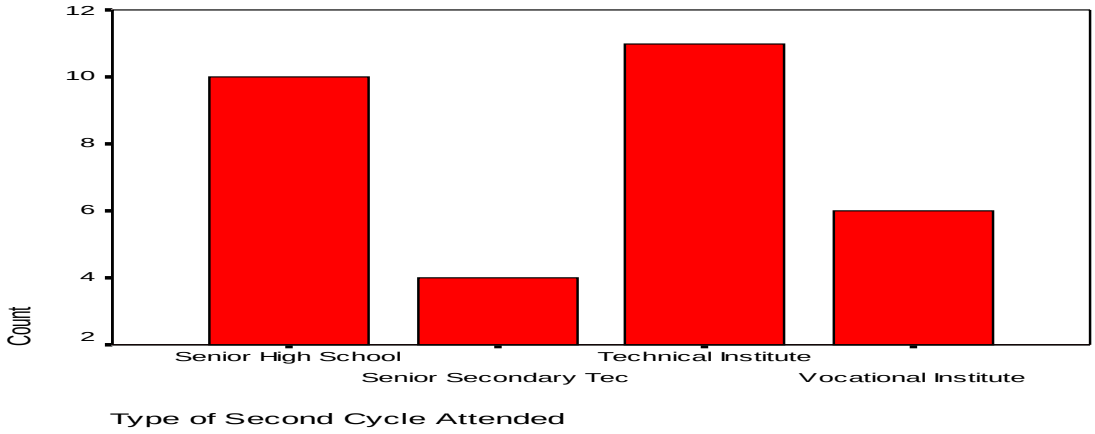

Figure 3: Type of Second Cycle School Instructors Attended

The chart in the figure 3 above shows the type second cycle school the CDVTI instructors attended after their first cycle education. It was observed that the majority of the instructors attended technical institutes. Senior high school followed closely, with a few of them having attended vocational and senior secondary technical institutes. This variety of basic second cycle education of the instructors is a good impetus to serve as basis to use as previous knowledge to coordinate and introduce the needed competencies and skills in teaching those courses they had learned. The sound basic knowledge also means that many would not encounter challenges in the art and science of infusing the educational methodologies and strategies in Mathematical competencies and skills in the classrooms.

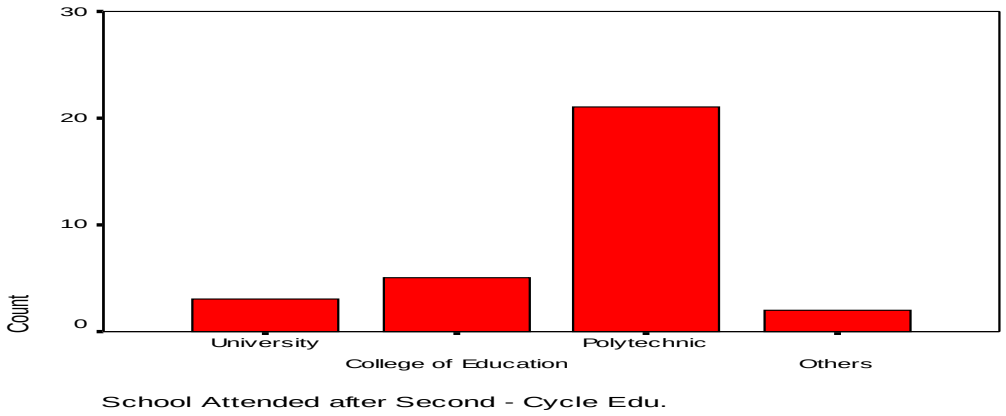

Figure 4: Type of School Attended After Second Cycle Education

The chart in the figure 4 above shows the tertiary schools CDVTI instructors attended after their second cycle education. It was observed that the majority of the instructors attended polytechnics, followed by the universities and other analogous tertiary schools. This variety of tertiary education means that they had the requisite content and curriculum experiences and knowledge from their tertiary education and training. Regrettably, the polytechnics and some universities have not been accredited to impart instructors with professional educational

methodologies and instructional strategies to function well in the classroom. It is therefore, important that the instructors acquire pedagogy, school management and child care education from the teacher-training tertiary institutions in Ghana and elsewhere.

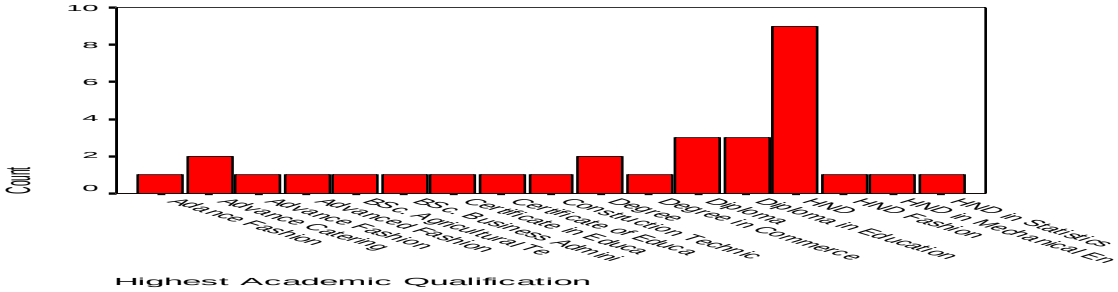

Figure 5: Highest Academic Qualifications of Instructors

The chart in the figure 5 above shows the highest academic qualifications of the CDVTI instructors. It was observed that the majority of the instructors obtained the Polytechnics' Highest National Diploma (HND). Some obtained degrees, diplomas, advanced and technician certificates. As pointed out earlier in figure 4, these qualifications are not meant for teaching, school management and child care, even though they might have been equipped with the needed content and curriculum knowledge and experiences. It is therefore, important that the instructors acquire basic competencies and skills in educational methodologies, classroom practices, school management and child care education from the teacher-training institutions in Ghana and beyond.

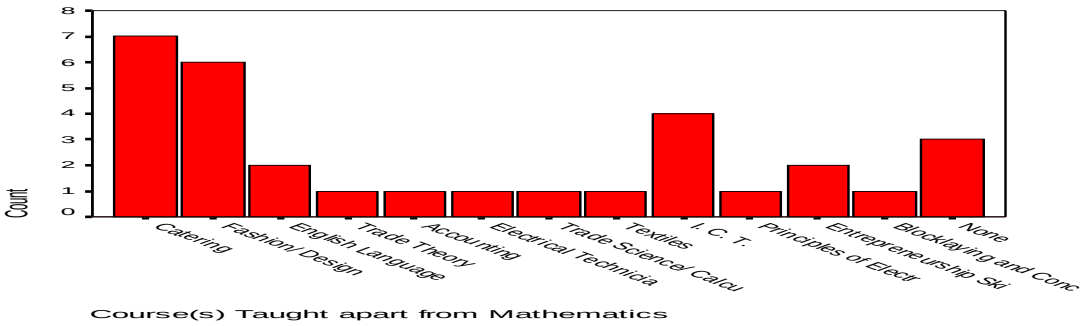

Figure 6: Courses Instructors Taught in the CDVTI Schools

The chart in the figure 6 above shows the courses the CDVTI instructors were teaching in the schools. It was observed that catering and fashion topped the careers. A few of them taught Mathematics. However, having introduced Mathematics alongside English Language and Science as core subjects for the CDVTIs, one would have expected to see instructors directly teaching it too. That notwithstanding, subjects like Accounting, Electrical Technicians, I.C.T. and Trade Science also require great deals of Mathematics. To some extent too, Catering, Fashion and Design need functional Mathematics to propel the teaching and learning of those subjects. Therefore, all these categories of instructors desire the professional teaching, learning, school management and child care competencies and skills. In other words, all these instructors need the competencies and skills as innovations to infuse into the teaching and learning process to propel science and technology to a much higher pedestal for accelerated national development.

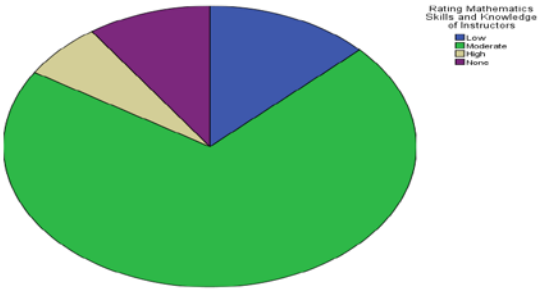

Figure 7: Self Ratings of Instructors' Mathematics Competence and Skills

The chart in the figure 7 above rated the general Mathematics competencies and skills of the CDVTI instructors. It was observed that most of the instructors had moderate competencies and skills. A few of them had high skills in Mathematics. However, Mathematics is now a core subject for the CDVTI institutes and demand highly skilled instructors to handle it. We therefore, need to infuse these competencies and skills in the instructors as innovations to raise the bars of Mathematics to strategic heights to serve as an anchor to the promulgation, promotion and enhancement of science and technology for national development.

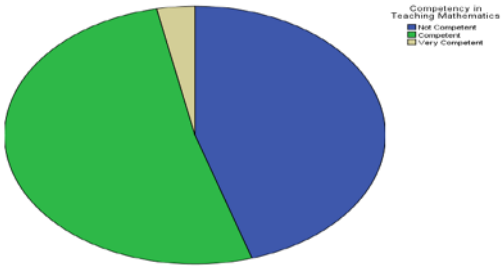

Figure 8: Instructors' Teaching Competencies and Skills

The pie chart in the figure 8 above rated the specific teaching competencies and skills of the CDVTI instructors. We discovered that a very few of the instructors had very competent knowledge of teaching Mathematics. However, given the sensitive nature of Mathematics to Ghanaian students, we need very competent and highly skilled Mathematics instructors to teach in the CDVTI institutes as happens in the senior high schools. This is one major way of ensuring that vocational education serves as the bedrock for advancing science and technology for Ghana's growth and development in the near future.

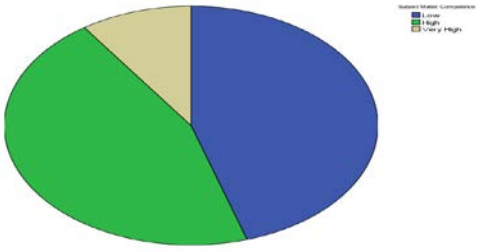

Figure 9: Instructors' Subject Matter Competencies and Skills

The pie chart in the figure 9 above rated the specific subject matter competencies and skills of the CDVTI instructors. It was revealed that a few of the instructors were very competent in the content of the Mathematics. Even though their subject matter base was better than their teaching, we still need very competent and highly skilled Mathematics instructors who are not only well versed with the course content, but also command the art and science of teaching and learning so that we fully tap and utilize the skills of the rural-based personnel to accelerate an all-round, comprehensive and inclusive national development.

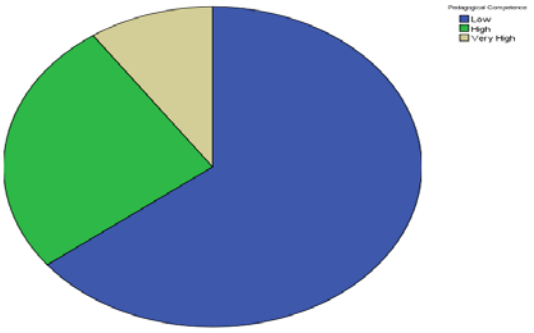

Figure 10: Instructors' Pedagogical Competencies and Skills

The pie chart in the figure 10 above rated the specific pedagogical competencies and skills of the CDVTI instructors. Again, it was observed that the level of very competent and highly skilled portion of the pie was the same as that of the subject matter. Pedagogy is very necessary in presenting and handling the classroom teaching and learning routine procedures and processes. We therefore, need these competencies and skills to exert meaningful and insightful learning to link up knowledge to practice in order to promote invention and innovation of mathematical ideas to advance and spearhead our quest for technological development in Ghana.

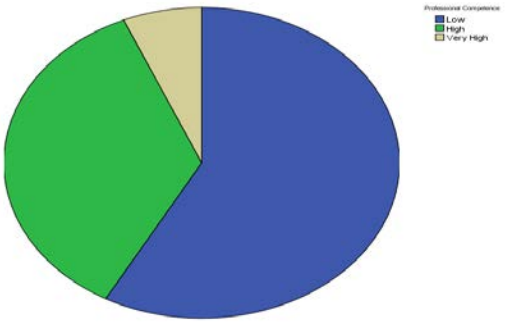

Figure 11: Instructors' Professional Competencies and Skills

The pie chart in the figure 11 above rated the specific professional competencies and skills of the CDVTI instructors. It was revealed that a few of the instructors were very competent in infusing professionalism into the teaching and learning processes. Every qualified, competent and skilled Mathematics instructor needs to appear in the school well prepared, focussed and poised for teaching, and has the spirits of calmness, tact and patience. They need effective communication skills, well projected voice and appropriate language that appeal to the respective levels of their students. These professional attributes of Mathematics would necessarily advance the

core mandate, mission and vision of CDVTI education and training to promote science and technology for national development.

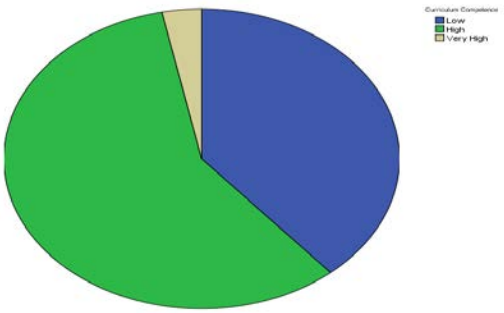

Figure 12: Instructors' Curriculum Competencies and Skills

The pie chart in the figure 12 above rated the specific curriculum competencies and skills of the CDVTI instructors. It was observed that very few of the instructors had high competencies in the curriculum of Mathematics in the CDVTI institutes. The curriculum entails the course content, syllabus, periods of lessons, clubs, societies and activities organised to promote the teaching and learning of Mathematics. With this abysmal portion of high competence, we need to aspire to produce and post very competent and highly skilled Mathematics instructors who have wide scope, vast knowledge and more experiences in the CDVTIs' Mathematics curriculum to help canvass and encourage students to pursue STI courses to speed up national development. The current status where these institutes have been narrowly dominated by fashion, design and catering courses would not fulfil the much wider anticipated goals of showcasing and propelling comprehensive community innovations and inventions for the much wider national goals of science and technology.

The Table 1 shows the tests of the Spearman's rank correlations among the five competencies and skills needed in the teaching and learning processes. We discovered that all the competencies and skills positively related to one another. There were also strong correlations as observed in values that were greater than 0.5. Therefore, no single competency would be sufficient enough for the instructors to acquire and function in their instructional career without the other(s). Policy makers must seek to recruit instructors, and instructors must also seek to acquire these competencies and skills before taking up any appointment in the CDVTI institutes. If instructors lurk behind these competencies, it would definitely affect students in the CDVTI institutes and the pace of development of the country, and the world at large [6].

These coefficients were further tested at 5% level of significance with their respective P-values of the relationships. The test values confirmed that all the competencies were significant as no P-value was greater than the stated level of significance of 0.05 in the table 1. However, subject matter and pedagogical competencies were more influential as they recorded more 0.000 P-values than the rest of the other three. This means instructors of CDNVTI need these two competencies more to imbibe into their educational methodologies and instructional delivery. We must point out here that these two competencies could easily be acquired from teacher-training universities and professional colleges in education. There is therefore the need for the CDVTI institutes to partner with the teacher-training universities and colleges to infuse these

competencies and skills to their instructors to promote effective science, mathematics, engineering and technology teaching and learning in order to boost development of nations.

Table 1: Spearman's Rank Correlations Coefficients for Competencies and Skills

Competencies	Teaching	Subject Matter	Pedagogical	Professional	Curriculum
Teaching	1.000	0.754	0.578	0.526	0.531
Significance	.	0.000	0.000	0.001	0.001
Subject Matter	0.754	1.000	0.758	0.549	0.709
Significance	0.000	.	0.000	0.001	0.000
Pedagogical	0.578	0.758	1.000	0.735	0.518
Significance	0.000	0.000	.	0.000	0.001
Professional	0.526	0.549	0.735	1.000	0.477
Significance	0.001	0.001	0.000	.	0.003
Curriculum	0.531	0.709	0.518	0.477	1.000
Significance	0.001	0.000	0.001	0.003	.

Table 2: Chi-Square Test Statistics for Competencies and Skills

Tests	Teaching	Subject Matter	Pedagogical	Professional	Curriculum
Chi-Square	12.839	7.806	14.774	12.452	14.387
Degree of freedom	2	2	2	2	2
Significance	0.002	0.020	0.001	0.002	0.001

The Table 2 above shows the Chi-square tests of significance of the five competencies and skills needed in the teaching and learning processes. With minimum expected frequency of 5 and minimum expected cell frequency of 10.3 for all the competencies and skills, and the fact that all Chi-square significant values were unanimously less than our stated significant value of 0.05, we can really confirm that these competencies are not only necessary but also sufficient reasons why CDVTI instructors do not deliver results as expected of them. Thus,

not only do they need to acquire subject matter and pedagogy, they must also acquire adequate competencies and skills in the other three.

Stakeholders must seek opportunities to inculcate these competencies into the instructors. If instructors get the opportunity to grasp these competencies well, as revealed by [6], trainees and other beneficiaries of CDVTI institutes would gain a lot of skills to make them independent, employable and real problem solvers. Without excellent competencies in science, mathematics, engineering and technology, countries and the entire world risk aggravating their unemployment rates, internal and external migration, and attended social vices that ripe the society off its ever challenged resources. The requisite training and education espoused by [22] and [20] must be teamwork other professional training institutions to make this noble dream come true. While agreeing that products of CDNTI institutes could progress in the existing polytechnics and technical universities, the teacher-training universities and educational colleges who are primarily charged with the responsibilities and mandate of training professionals in the teaching careers should partner these CDVTI institutes to produce very competent and highly skilled instructors in the five competencies in science, mathematics, engineering and technology. This would serve as a pace setter to champion the vision and mission of every nation's science, mathematics, engineering and technology policy to accelerate national and international growth and development.

5. Conclusion

The study explored how teacher-training institutions could partner vocational institutions to infuse competencies and skills in CDVTI instructors to enhance the quality of teaching and learning in order to boost science, mathematics, technology and innovation for national development. The findings revealed that the transformation of the then CDVTI intitutes and the subsequent introduction of Mathematics and other new core courses had inevitably improved the general wellbeing of the rural communities in diverse ways. We should also peruse these five inter-related and interconnected competencies and skills of all the instructors in the CDVTIs to motivate students pursue careers in science, mathematics and technology domains. Since Mathematics is the bedrock of science and technology, we cannot disregard its effective teaching and learning on our forward looking course. It is therefore, important for stakeholders to engage and train these CDVTI instructors with these necessary competencies and skills to boost science, mathematics engineering and technology for national development. These would eventually build rural skilled manpower, create jobs, reduce unemployment, reduce migration, and reduce. We therefore, suggested the following ways to help herald this call.

1. As we discovered that many young people were ready and willing to teach in the CDVTI institutes, governments and other stakeholders should consider expanding facilities and diversifying programmes in the CDVTI institutes. These noble innovations would employ many more young graduates, reduce rural-urban migration and eradicate many social vices peculiar to the youth.

2. We found out that enrolments of students and instructors in the relatively developed urban CDVTI institutes were abysmally low, and in deplorable states. This lack of interest of urban dwellers suggests that these CDVTI institutes should have rather been established in the rural areas. This would ensure effective and efficient community participation, utilization and innovation of the resources being

channelled into this sub-sector so as to improve lives and to reap the benefits of public social investments.

3. The CDVTIs grappled with a lot of administrative and classroom challenges. To assess and assist these institutions, there must be periodic collaborative policy reviews among the Colleges of Education, Universities, Polytechnics, governments, and most importantly the professional subject associations to enrich teaching, profession, pedagogy, content and curriculum.

4. We found out that very few personnel taught Mathematics. Even the few who accepted this enormous challenge were products of non-teacher training institutions, and hence, lacked competencies and skills in teaching. To enrich their competencies and skills, there must be periodic and continuous training and education. In doing this, the teacher-training universities and Colleges of Education should train the staff in teaching, professional and pedagogical domains while the polytechnics and other tertiary institutions take on the subject matter and curricula domains.

5. The instructors in Principles of Accounting, Costing, I.C.T. and other quasi-mathematics programmes could be redeployed and reassigned to teach Mathematics as stop gap measures. However, academic progression opportunities should be extended to them to ensure favourable competition with analogous personnel in the education service sub-sectors. The examinations council, boards and bodies should also synchronize the examinations syllabi and timetable to ensure that CDVTI students write the same examinations with other analogous students at high school levels. This will compel instructors to upgrade their competencies to the levels of other tutors in their levels of practice.

6. To up-grade the untrained instructors, incentives and scholarships should be strategically channelled to CDVTI instructors to pursue further studies targeted to equip and develop their competencies and skills necessary to stay relevant in the classroom. In doing this, much more allocations should be channelled or directed to the training and education of instructors of science, mathematics, engineering and technology courses [24].

7. To ensure parity in wages and other conditions of service, the CDVTI institutes should be realigned with education service sector. The current practice in Ghana where CDVTI institutes have been aligned to the loca government and communities does not ensure education directors have the mandate to recruit, post and transfer highly competent and skilled teachers and instructors to the CDVTI institutes to boost the teaching and learning of STI programmes.

References

[1]. J. Avery. Resources for Teaching and Learning. Washington: Green River College. 2015 [www.instruction.greenriver.edu/avery/faculty/pres/tesol04/comptetencies3.html].

[2]. Humphrey Institute of Public Affairs. List of Skills and Competencies Used in Public Service

Careers. University of Minnesota: Office of Career Services. 2015.

[3]. L. Brewer. Enhancing Youth Employability: What? Why? and How? Guide to Core Work Skills. Geneva: Skills and Employability Department/ILO. 2013 (4-14).

[4]. The Career Group. Competencies and Skills: What are they and how do you show you have them? University of London: Queen Mary Careers. 2012.

[5]. C. Nielson. Coaching organizations for breaking through performance. The Nielson Report, Volume 8, Issue 12. Texas: Bill J. Bonnstetter and Bill Brooks. [www.nielsongroup.com]. 2003 (1-7).

[6]. C.A. Ali and P. Akayuure. Mathematics as a Tool for Enhancing Competitiveness and Employability of Vocational Training Institutions in Ghana. International Journal of Entrepreneurial Development, Education and Science Research, Vol.2 No 1, July 2014.

[7]. N. Burnett. and S. Jayaram. (2012). Innovative Secondary Education for Skills Enhancement (ISESE) for Employability in Africa and Asia. Addis Ababa: ISESE Skills Synthesis Paper October 2012 Results for Development Institute (R4D).

[8]. The United Nations. Science, technology and innovation for sustainable development in the global partnership for development beyond 2015. Washington D.C.: UN System Task Team on the Post-2015 UN Development Agenda. 2015 (4-5).

[9]. F. Block and M.R. Keller. Where Do Innovations Come From? Transformations in the U.S. National Innovation System, 1970-2006. University of California: The Information Technology & Innovation Foundation (ITIF). 2008.

[10]. M.D.P. Ikounga. Science, Technology and Innovation Strategy for Africa 2024, On the Wings of Innovation", the Science, Technology and Innovation Strategy for Africa (STISA-2024). Addis Ababa: The Mission of STISA-2024. 2014 (46-47).

[11]. C. Hill, C. Corbett and A. Rose. Why So Few? Women in Science, Technology, Engineering and Mathematics. Washington, D.C.: AAUW. 2010 (2-29).

[12]. C. Holroyd. (2007). Science and Technology Policies, National Competitiveness, and the Innovation Divide. Ontario: Centre for International Governance Innovation, Working Paper 32. 2007 (1-3).

[13]. Ministry of Science and Technology. Science, Technology and Innovation Policy 2013. New Delhi: Government of India. 2013 (5-21).

[14]. L. Brito. The Role of Science, Technology and Innovation Policies and Instruments for a Paradigm Shift towards Sustainable Development. Paris: Division of Science Policy and Capacity Building, United Nations Education, Science and Cultural Organization. 2014 (1-8).

[15]. Ministry of Science and Technology--MoST (2013). Science, Technology and Innovation Policy 13. New Delhi: Government of India and Paras Offset PVT Ltd. 2013.

[16]. Ministry of Environment, Science and Technology. National Science, Technology and Innovation Policy. Accra: Ministry of Environment, Science and Technology. February, 2010 (29-34).

[17]. The Office of Science and Technology Policy--OSTP. The 2015 Budget: Science, Technology, and Innovation for Opportunity and Growth. Science, Technology, Innovation, and STEM Education in the 2015 Budget. Washington D.C.: White House Office of Science and Technology Policy [www.whitehouse.gov/ostp]. July 2014.

[18]. Republic of Albania (2009). National Strategy of Science, Technology and Innovation 2009–2015. Science, Technology and Economic Development in South Eastern Europe, UNESCO-ROSTE Science Policy Series N°1, 2005. Tirana: Council of Ministers. 2009 (17-22).

[19]. A. Mallik. Technology and security in the 21st centaury: A Demand Side Perspective, Stockholm International Peace Research Institute--SIPRI Research Report No. 20. Solna: Oxford University Press. 2004 (1-16).

[20]. Government of Ghana. National Science, Technology and Innovation Policy. Accra: Ministry of Environment, Science and Technology Draft Policy. 2009.

[21]. Science, Technology and Innovation Council. Science, Technology and Innovation Council (2013). State of the Nation 2012, Canada's STI System: Aspiring to Global Leadership. Ottawa: Science, Technology and Innovation Council Secretariat. 2013.

[22]. S.L. Sellers, J. Roberts, L. Giovanetto, K. Friedrich and C. Hammargren. Reaching All Students; A Resource for Teaching in Science, Technology, Engineering & Mathematics, 2nd edition. Wisconsin: Centre for the Integration of Research, Teaching, and Learning. 2007 (55-155).

[23]. National Research Council. Science, Technology, Society and the Environment. A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Committee on a Conceptual Framework for New K-12 Science Education Standards. Board on Science Education, Division of Behavioural and Social Sciences and Education. Washington, DC: The National Academies Press. 2012.

[24]. J. Thomasian. Building Science, Technology, Engineering, and Math Education Agenda; An Update of State Actions. Washington, D.C.: Black Point Policy Solutions, LLC and NGA Centre for Best Practices. 2011 (9-34).

[25]. National Science Board. Research and Development, Innovation, and the Science and Engineering; a Companion to Science and Engineering Indicators. Virginia: National Science Foundation. 2012 (10-12).

[26]. Alam, G.M. The role of technical and vocational education in the national development of Bangladesh. Asia-Pacific Journal of Cooperative Education, 2008, 9(1), 25-44.