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# PAPER 6

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## HUMAN CAPACITY DEVELOPMENT IN STEM EDUCATION FOR ATTAINING MDGs: A CASE STUDY OF UNIVERSITY OF UYO, NIGERIA

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### **Abstract**

*This study was on human capacity development in STEM education for attaining MDGs. It was a descriptive survey research design with three research questions guiding the study. The instrument for data collection was a Questionnaire developed by the researchers and face validated by a lecturer in test and measurement and two lecturers of Science Education Department all from the University of University of Uyo, Akwa Ibom State. Using simple random sampling technique a total of 62 STEM teachers from the Faculty of Education of the University of Uyo were sampled for the study. A descriptive statistics of mean ( $\bar{X}$ ) was used to analyze the data. The findings of the study showed that University STEM teachers need to use productive research results and findings to internalize STEM students' knowledge and they need entrepreneurial resources and appropriate funding to develop their capacities for STEM teaching. Based on these findings, it was recommended amongst others; that specialized laboratories be provided for STEM teachers for collaborative networking to attain MDGs objectives.*

### **Introduction**

Modern trends in science teaching in meeting global best practices cannot be underestimated in today's changing world. Scientific researches and innovative science ideas have reached high global standards in advanced nations and is catching up with few sub-saharan nations. Nigerian STEM teachers, particularly in our universities need to come to terms with these changing realities on STEM teaching and fall in line with the type of STEM education given to learners to make them relevant in a highly knowledge-based competitive world. The university is set as a specimen and a template to bring forth great ideas using researches. It is a place for the training of great minds and students are to be properly equipped at this level to face future challenges. The university is a place where students are trained and produced as STEM graduates to enable them teach at the primary and secondary school levels. In order to achieve the MDGs, it is important to professionally develop university STEM teachers to help them see and nurture students as the future. STEM teaching is changing in so many ways and students of STEM will learn high level skills for logical reasonings, such as how to evaluate, analyze, synthesize high volume of information and find creative ways to apply these information to solving problems in their daily-living-activities.

Human capitals are the tools through which the needed fundamental scientific interest and attitude can be infused into the future scientific and technological manpower of the nation (Adedayo, 2011). The tools to bring about these changes are the university STEM teachers. The success of any STEM curriculum depends to a very large extent on the availability of scientifically and technologically trained manpower. Without

available manpower and development of STEM university teachers to teach STEM courses, STEM education will continue to experience pitfalls in the attainment of MDGs. FRN (2004) specifies that, a science educator is a person who has undergone approved professional training in education at appropriate levels capable of imparting scientific knowledge, attitudes and skills to the learners. There is need to have deliberate efforts to ensure that STEM teacher education includes techniques that enable teachers to function beyond textbooks and be able to design teaching materials that can emphasize the effective domain, plus the decision-making and problems-solving (Holbrook, 2009).

All cadre of STEM teachers are being fully mobilized to see the need to develop a more systematic, broadened, career-oriented and hands-on-skills targeted at continued improvement of STEM teaching. Building the best of current knowledge-practice, and standards will move STEM teachers toward a shared vision of excellence for actualizing MDGs.

The present scourge of unemployment in Nigeria clearly reveals that the STEM taught in schools at all levels do no prepare Nigerian graduates to function well as expected (Nwachukwu, 2009). Nwachukwu further stated that the courses which should be taught as hands-on, minds-on practical courses are taught theoretically and this make the learners not to benefit maximally from their education. STEM teachers must be prepared to tackle the wide gap between research and practice in STEM, improve assessment methods and encourage professional developments of STEM teachers (Holbrook, 2009). There has been an abysmal poor performance of students' in STEM courses in the universities, as this reflects in their semester examinations, job aptitude tests, scholarships and qualifying examinations for awards. Hardly, do STEM students do well, and as (Adedayo, 2011) puts it, if STEM Education would worth its purpose, STEM education must be repositioned.

The Millennium Development Goals (MDGs) makes universal primary education as its second goal and anticipates achieving its objectives by the year 2015. Realizing this laudable vision is to ensure that all concerned must join hands to reduce illiteracy to its barest minimum using implementable guidelines that will bring quick opportunities to make sense of the world holistically, rather than in bits and pieces (Omosewo, Olorundare, Abinbola, Upahi, 2012).

The National Policy on Education (FRN, 2004) is predicated on the belief among others; that developing the capacities and potentials of the human resources, as well as the development of a competent workforce is a veritable means of developing sound intelligent learning societies. Implementing this policy therefore, for adequate STEM teachers capacity development for STEM education in the universities will greatly address the dearth of competent and skilled STEM teachers needed to implement MDGs objectives. This will also motivate STEM teachers interest and attitude in promoting qualitative-based STEM teaching. STEM education taught by university STEM teachers must look beyond classroom in curriculum contents to developing STEM learners innate abilities and skills if the MDGs objectives are to be attained by 20-2020. This will ensure effective teaching of STEM courses through adequate production of STEM quality teachers who will in turn ensure STEM basic foundational knowledge and skills. Qualified STEM teachers <sup>who are</sup> <sup>with</sup> <sup>adeq</sup> <sup>del</sup> appropriately trained and skills <sup>with</sup> <sup>required</sup> <sup>needed</sup> are required in sufficient numbers today than ever before to render the required services for attainment of the MGDs.

Research is a systematic and scientific method of knowledge acquisition that attempts to provide answers to questions. Research brings abstract scientific concepts into virtual reality. New ideas, basic skills and knowledge for creativity are generated through research. Researches drive scientific and technological advancement and equip young minds to learn to solve problems logically. The right application of research

findings facilitates teachers' productivity. Educational research offers the possibility of increasing the efficiency of the learning process and hence, of the productivity of learning in science (Akpan, 2005). When researches are fully utilized, it impacts on teachers' method of teaching, facilitate improvisable ideas, provide right practicals that will adequately impact on learners scientific knowledge and skills. University teachers need proper training on research work on STEM education to effectively deliver STEM, courses for learners' knowledge. Jegede (2003) argued that the responsibility for professional development and the focus upon capacity – building must include research as its main source to feed all evaluation, development and implementation of standards based STM education. STEM university teachers should find and spend quality time going through researches in journals, bulletins, science proceedings and seminars to acquire more knowledge on STEM delivery. Science educational researches are carried out in most Nigerian universities and findings written in journals, but few STEM teachers ever go through these journals to find new developments on their specialized teaching content areas and apply to evolving teaching dynamics. In such cases, STEM teachers cannot update current information nor decode new scientific facts for appropriate information for STEM learning. This greatly impairs the realization of MDGs. Friedman (1976) in Eniayeju (2010) observed that teachers of STEM do not give enough attention to the explanations on the nature of proofs and neither do they ask questions that require higher order thinking comparable to those found in public examination papers. This is because university STEM teachers do not take pains to look into researches on existing novelty to update knowledge. Hence, there exists a wide gap between available educational opportunities and human capacity development among Nigerian University STEM teachers. There is need therefore, to maximize teachers' capacity development by putting in place research productivity packages and entrepreneurship programmes to empower STEM teachers to build learners creative skills and potentials for implementation of MDGs.

Entrepreneurial resources all those resources that encourages STEM to build caps for producing. These include technology and science specialized laboratory, machine, tools and equipment. The teacher cannot teach effectively if equipment and facilities and lacking for learners skill acquisition. Oraifo (2002) w noted that STEM education in Nigeria is characterized by inadequacy of content and ineffective methodology by teachers, dearth of facilities, equipment and materials in our laboratories, as well as dominated socio-cultural lapses. STEM teaching becomes easier, less time consuming and exciting with new knowledge and modern facilities that engage students productivity. STEM education for MDGs will not be realized if STEM teachers are not exposed to training on effective management, manipulation and handling of entrepreneurial resources that promote students' entrepreneurial skills, ideas and creativity. Inadequate STEM equipment has resulted in ill-equipped university STEM teachers. This grossly affects STEM teachers output and limits achievement of MDGs.

Funding is a necessity STEM teaching to achieve MDGs. Training, materials, and conducive learning environment will make teachers put in their best. Inadequate funding is hampering the capacity building of STEM teachers and this affects the proper implementation of the MDGs. Science, technology and mathematics education in Nigeria is characterized by inadequacy of content and ineffective methodology by teachers, dearth of facilities, equipment and materials in our laboratories, as well as dominated socio-cultural lapses (Oriafo, 2002). The success of the MDGs need concerted effort by all. This study, therefore seek ways of attaining the MDGs objectives through STEM teachers development. Specifically, the study intended to find out:

1. The productive researches in place for STEM teachers' capacity development for MDGs.



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1. The productive researches in place for STEM teachers' capacity development for MDGs.

2. The entrepreneurial resources available for STEM teachers' capacity development for MDGs.
3. Funding provided for STEM teachers' capacity development for MDGs.

### Research Questions

1. What productive researches are in place for teachers' capacity development for MDGs?
2. What entrepreneurial resources are available for STEM teachers' capacity development for MDGs?.
3. What funding is provided for teachers' capacity development for MDGs?.

### Research Method

The study adopted a survey research design. The population of the study comprised all the STEM teachers in the Faculty of Education, University of Uyo, Akwa Ibom State. Using simple random sampling technique, a total of 62 STEM teachers (18 from Science Education Department, 20 from Educational Media and Technology Department and 24 from Vocational Education Department) were selected as the sample size for this study. The instrument used for data collection was STEM teachers capacity Development for MDGs Questionnaire. The instrument was structured on a 4-point rating scale of Strongly Agree (SA = 4), Agree (A = 3), Disagree (D = 2) and Strongly Disagree (SD = 1). The instrument was face-validated by two lecturers from science education department and one lecturer in Educational Foundation Department that specializes in test and measurement, all from the University of Uyo, Akwa Ibom State. Mean ( $\bar{X}$ ) was used to analyse the data collected. Mean ( $\bar{X}$ ) score below 2.50 was not accepted, but a mean ( $\bar{X}$ ) of 2.50 and above was accepted.

**Table 1:** *Mean ratings of responses on productive researches in place for STEM teachers' capacity development.*

S/N	Productive researches for STEM teachers' capacity development	Mean ( $\bar{X}$ )	SD	Decision
1	New knowledge for local relevance	3.35	0.63	A
2	Expertise in research priority	3.10	0.79	A
3	Centres for research activities	2.73	0.80	A
4	Employing science process skills	3.29	0.73	A
5	Engaging prior knowledge for established researches	2.80	0.82	A
6	Networked journal materials for knowledge adaptation	3.02	0.83	A
7	Mentored and mentoring others	3.76	0.87	A
8	Modifying lesson contents with research findings	2.68	0.76	A

From Table 1, it is shown that STEM teachers' responses had high mean ( $\bar{X}$ ) ratings on all the items indicated for their capacity development in achieving MDGs targets. The mean rating of each item is above 2.50 which is the decision level.

**Table 2:** *Mean ratings of responses on available entrepreneurial resources for STEM teachers' capacity development.*

S/N	Entrepreneurial resources for STEM teachers' capacity development	Mean ( $\bar{X}$ )	SD	Decision
9	Specialized laboratories	2.85	0.71	A
10	Machines	3.21	0.84	A
11	Tools/equipment	2.93	0.79	A

12	Workshops/production rooms	3.30	0.86	A
13	Programmed studios	2.53	0.54	A
14	Improvised equipment fabrication	2.71	0.76	A

From Table 2 above, it is shown that all the items responded to by STEM teachers had high Mean (X) ratings. The mean rating of each item is above 2.50 which is the decision level.

**Table 3:** Mean ratings of responses on provision for funding STEM teachers' capacity building.

S/N	Provision for funding STEM teachers' capacity development	Mean (X)	SD	Decision
15	School administration initiatives	3.18	0.78	A
16	Community initiatives	2.78	0.69	A
17	Non-governmental organizations	3.16	2.82	A
18	Institutional collaboration	3.29	0.74	A
19	Government involvement (all cadre)	2.21	0.62	D
20	Foreign investment	3.06	0.71	A

From Table 3, it is shown that each of the items had a mean score of above 2.50 which is the decision level except for item 19 that the STEM teachers disagreed.

### Discussion of Results

The results of this study have shown that STEM teachers are grossly deficient in capacity-building skills on productive researches that would have properly equipped them to respond effectively to the actualization of the MDGs. This is a serious disadvantage to the implementation of MDGs objectives particularly as it affects its graduates who are trained out of the Universities to train young learners. This finding is in agreement with Friedman (1976) in Eniayeju (2010) who posited that teachers of STEM do not give enough attention to the explanations on the nature of proofs and neither do they ask questions that require higher order thinking comparable to those found in public examination papers. STEM teachers would have been able to do these and more if they consulted the various researches on conferences, workshops and seminars. They would have gained appropriate knowledge if they participated and engaged in productive researches themselves.

Table 2 also revealed that STEM teachers responses on entrepreneurial resources for teachers capacity development are far too few and inadequate to meet the challenges of MDGs. This finding is in agreement with Oraifo (2002) who noted that STEM education in Nigeria is characterized by inadequacy of content and ineffective methodology by teachers, dearth of facilities, equipment and materials in our laboratories, as well as dominated socio-cultural lapses. Without adequate entrepreneurial resources, knowledge cannot be internalized and deployed for future productive use. Findings in Table 3 revealed that there was no provision on funding except for Government involvement. This is far too little to cater for the large number of STEM teachers who may be willing to undertake training and retraining on STEM courses. This negatively impacts on STEM teachers' productive output on the students.

### Conclusion

It is imperative to seek cheaper, better and achievable ways of building STEM teachers capacity using collaborative networks for a more engaged service delivery towards the attainment of MDGs.

### Recommendations

Based on the findings of this study, the following recommendations are proffered:

1. The University authority, Deans and Head of Departments should create a STEM teachers interactive forum for collaborative networking on a regular basis to improve their capacity development.
2. School authorities should engage experienced STEM teachers with expertise on handling entrepreneurial resources.
3. Special entrepreneurial laboratories should be built in schools for fabricating resources that will enable STEM teachers utilize materials efficiently.
4. Funding should be provided by all tiers – of – government to encourage STEM teachers training and re-training for the MDGs.
5. Governments should do more through funding to develop infrastructure, equipment and machines to accommodate large student intake into the university.

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