THE GAP BETWEEN TEACHING AND RESEARCH IN SCIENCE EDUCATION

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Abstract

The relationship between teaching and research in science education is often assumed and just as often ignored. Research should and does influence teaching (and vice versa), but the gap between the two can at times seem large. Teachers are told to use "research-based strategies" and yet such strategies may be presented to them stripped of the very sensitivity to context, analytic rigor, and thoughtful skepticism that are the hallmarks of quality research. This paper examines the gap between teaching and research in science education. It is an attempt to provide a foundation for conversations about concept of teaching and research in science education, how teachers might use it, and how to create and sustain communities of science education professionals who use and conduct research in meaningful and responsible ways. Conclusion and recommendations were made.

For many people, the link between research and teaching remains unquestioned. The assumption seems to be that academics base their teaching content on research in their field and that this is beneficial to learners. Closer scrutiny indicates that the relationship between teaching and research may not always be harmonious or beneficial to learners. Present day academics may be surprised to learn that the emphasis on research in the universities is a relatively modern phenomenon that derived primarily from the German universities and really only took strong hold in the 20th century (Hattie & Marsh, 1996).

Furthermore, the relationship between research and teaching has been increasingly contested by education scholars (Haigh, 2010). The assumption that content–based research inevitably benefits students has been challenged and other ways of synergizing these two facets of academic life to maximize the benefits for student learning have been examined and developed.

Science education deals with sharing of science content and process with individuals who are not considered traditionally to be member of the scientific community; the individuals could be students, farmers, market women or a whole community. Science education in Nigeria concentrates on the teaching of science concepts, method of teaching and addressing misconceptions held by learners regarding science concepts. Science education is very important to the development of any nation (Omosewo, 2005), that is why every nation must take it very serious in all institutions of learning. Many of the developed worlds were able to achieve so much in science and technology because of science education. Launching of sputnik by the Russian government in October, 4 1957 would not have been possible if not for the position they placed physics in science education (Omosewo, 2005). Science education comprises three subjects namely biology, chemistry and physics which are combined with education and over the year there has been low enrolment of these courses in our institutions as identified by (Aina, 2002); causes of this low enrolment include society disdain, mockery of teacher and low prestige of teachers (Okebukola, 1998).

Concepts of Teaching

Teaching is an abstract art. As a teacher one must enter the mind of one's student with the intent to engage. A teacher must engage ones student in the process of absorbing, understanding, applying, and then retaining new knowledge. It is said that it takes the average human 21 days to create a new, repetitive behavior. It takes 30 days to make the habit part of one's everyday life.

In games of physical sports the mind and the body must come together to take the knowledge given by a teacher to a new level. Not only does the basketball student have to incorporate their cerebral cortex but also their body in the learning of new concepts to master the game. The athlete must transcend the mind to bring to the court physical performance. In regular classroom settings, students learn concepts and facts that they may never use in their day to day living. Special techniques are required to take concepts from the chalkboard to the court. The magic happens when coaches spark the desire of the athlete to use their bodies to perform the mental pictures and concepts in their minds during the heat of competition. It may be difficult to explain to the athlete that one must use ones instincts about one's body, to learn one's body, in order to become a phenomenal player. Concepts like power from the legs, concentration, focus, adrenaline, may not be at first easy for the young athlete to understand. Mature athletes will say that the best teacher they ever had was experience. This is where the concepts of teaching come in to assist a coach in helping their young athlete learn while they gain that experience.

Concept of Research

Research comprises "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humans, culture and society, and the use of this stock of knowledge to devise new applications. It is used to establish or confirm facts, reaffirm the results of previous work, solve new or existing problems, support theorems, or develop new theories. A research project may also be an expansion on past work in the field. To test the validity of instruments, procedures, or experiments, research may replicate elements of prior projects, or the project as a whole. The primary purposes of basic research (as opposed to applied research) are documentation, discovery, interpretation, or the research and development (R&D) of methods and systems for the advancement of human knowledge. Approaches to research depend on epistemologies, which vary considerably both within and between humanities and sciences. There are several forms of research: scientific, humanities, artistic, economic, social, business, marketing, practitioner research, etc.

Research has been defined in a number of different ways

A broad definition of research is given by Martyn Shuttleworth (2008) to include any gathering of data, information and facts for the advancement of knowledge (Shuttleworth, Martyn 2008).

Another definition of research is given by Creswell who states that - "Research is a process of steps used to collect and analyze information to increase our understanding of a topic or issue". It consists of three steps: Pose a question, collect data to answer the question, and present an answer to the question.

Concept of Science Education

Science education is the field concerned with sharing science content and process with individuals not traditionally considered part of the scientific community. The learners may be children, college students, or adults within the general public. The field of science education includes work in science content, science process (the scientific method), some social science, and some teaching pedagogy. The standards for science education provide expectations for the development of understanding for students through the entire course of their K-12 education and beyond. The traditional subjects included in the standards are physical, life, earth, space, and human sciences.

The practice of science education has been increasingly informed by research into science teaching and learning. Research in science education relies on a wide variety of methodologies, borrowed from many branches of science and engineering such as computer science, cognitive science, cognitive psychology and anthropology.

Science education research aims to define or characterize what constitutes learning in science and how it is brought about.

Importance of Science Education

Science education is very important to the development of any nation in many areas. A graduate of physics education can be self employed as opined by (Tunde, Akintoye & Adeyemo, 2001). Many of the physics graduates have some knowledge of electronics that is enough for them to be able to have a little period of training as apprentices and then stand alone as electronic technician. For instant, Semiconductor is very important in the modern technology that if properly learnt it is enough for one to stand upon for a living; semiconductor physics is part of what any graduate in physics will learn and should learn. In (Aina, 2005) semiconductor, is very important in a growing economy like ours in Nigeria; it is useful in ceramic industry and a well trained physics education graduate can be well established in ceramic industry.

Without science education Information and Communication Technology would be impossible. Science and technology will not be possible without science education; for instance engineering, medicine, architecture etc will not be possible if there is no one to teach the students the core subjects needed for these courses.

Biology education is very important to any growing economy like Nigeria. Many graduates of biology education are self employed and employers of labour; many owned schools for themselves where people work and earn their living while some are in to fishing business.

There are colleges of education where students of chemistry department are taught how to make dye and chalk; graduates of these departments can establish their own chalk business as soon as they graduate. If supported with fund many schools do not need to buy chalk outside anymore and they can equally produce for other schools.

The Gap between Teaching and Research in Science Education

A research-practice gap is generally recognized by educational researchers and teachers (e.g., Kennedy 1997; McIntyre 2005), and it is also a problem in science education (Pekarek, Krockover and Shepardson 1996). Kennedy (1997) discusses four hypotheses proposed to explain the perceived lack of connection between research and practice: (1) research is not sufficiently authoritative and/or persuasive, as a consequence of limits in its non experimental methodology; (2) research needs to be more relevant to teachers' concerns and classroom work; (3) research needs to be more

accessible to teachers; and (4) the education system itself is either too stable or too unstable to be able to respond coherently to research findings.

The meaning of the "relevance" of research to practice should be questioned from the standpoint of both teachers and researchers. The dilemma of relevance can be partly solved by a process of teacher education with regard to the nature of research and research-based knowledge. Moreover, reflective practice is also another avenue for solving the problem of relevance. Researchers, in turn, need to focus on questions resulting from the needs and concerns of teachers and other actors of the school system (Hargreaves 2000).

Changes in teaching practice will not follow, thus, from the simple act of informing teachers about research results. The dilemmas related to the relevance and accessibility of research can be discussed in terms of the necessity of framing research-based knowledge in an epistemological form that is more accessible to teachers and more in agreement with the reality of their work and knowledge.

Research might influence practice if one could improve the methods, research questions, dissemination, or some other characteristic of academic work. Several features of the educational systems hold back the influence of research over teaching practices. These systems would be either too stable and, thus, incapable of changing, or inherently instable, because of their susceptibility to passing fads. In one way or another, they would be incapable of answering in a coherent manner to educational research.

McIntyre (2005) puts forward a different perspective on the research-practice gap, which can be connected with Kennedy's arguments about relevance and accessibility. From this perspective, the gap is primarily seen as a problem of relating two contrasting kinds of knowledge, which are at the opposite ends of a spectrum of kinds of knowledge related to classroom teaching and learning. Teachers' everyday work demands a kind of pedagogical knowledge that is very different from the knowledge that educational research is well equipped to provide. By 'pedagogical knowledge', we mean the knowledge that directly informs teachers' practice in managing classrooms and mediating students' learning. This is 'knowledge 'how' and is very different from the kind of knowledge to which research typically leads, which is propositional knowledge. (McIntyre, 2005). Since research-based propositional knowledge cannot be simply translated into pedagogical knowledge, several steps are needed to bridge the gap between them. These steps from academic knowledge to practice, and from practice to academic knowledge, will become much easier if teachers

and researchers are brought together in truly collaborative teams. In this manner, we will be in a better condition to make research-based knowledge accessible to teachers, even in cases in which their beliefs are challenged by findings and ideas about teaching and learning that seem counter-intuitive.

Conclusion and Recommendations

In this paper, we set out to discuss how teachers and researchers can bridge the gap between educational research and teaching. Our position is not to seek a total overlap between these two domains. Instead, it is to ensure that the research domain aids in the development of teaching practices and that the situated teaching provides important perspectives into educational research. However, teachers rarely get the time to see the whole picture of their practice and many live isolated from research findings and theoretical debates about key issues of science education (Hodson & Bencze, 1998): As a consequence they often reproduce their own practice.

Further, Hodson and Bencze (1998: 692) state: "Because teachers' views are built up over a long period and are burnished in the furnace of everyday practice, challenges must be vigorous and explicit if change is to occur".

Through the authors' experiences during the two action research projects and reflection afterwards, we suggest that the concepts of multi-voice and tools are useful supplements to a collaborative action research approach. We advocate that multi-voice and tools provide an opportunity to challenge an established practice.

There is a gap between teacher and researcher in action research due to different roles, positions and focus (Herr & Anderson, 2005) thus what Engeström (2001) calls multi-voice. In our opinion, the teachers and researchers must be explicit about their positions throughout the entire collaboration. The researcher and teacher can open up and explicate their different positions, as in the case of Ellen and Gerd, where they challenged each other in their understanding of "good resources for learning". The concept of multi-voice provides an understanding of teachers and researchers' different point of views as a force for developing a practice. Further, the concept of multi-voice raises the awareness of relevant theory as a significant voice itself and contributes to the aim of collaboration.

There will always be a gap between teaching and educational research. The research provides perspectives to understand education in general and, in our cases, science inquiry in particular while teaching provides perspectives on the situated practice. However, the teacher might not have experienced educational literature as

relevant; it has little to contribute to his or her particular practice. Moreover, perhaps, research is too often prescriptive in the sense that it gives teachers long lists of "you ought to do". To avoid patronizing the teachers' practice, (Heron, J., & Reason, P. 2006), experienced that working together to design tools to be used in science education proved to be a driving force for sustainable change. In addition, the process of translation and negotiation between teacher(s) and researcher(s) can be seen as a possibility for personal growth.

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