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Translating Research Findings for Science Teachers: Best Practice for Science Teaching

By

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Abstract

Research in science education has begun to witness a commendable growth in the last two decades. Research findings from mathematics and science-related courses have been reported in several seminars, workshops, conferences, local and international journals, yet, the impact of these researches seem to have remain little, or somewhat unfelt. The reasons attributed to this minimal impact could includes: Researchers have concentrated largely on the generation of research findings, and have given low priority to exploring their implications for, and application in, the classroom; undue attention given to fashionable research areas without adequate consideration of the practical usefulness of the research findings; the inadequacies of research recommendations to provide implications of findings to actual classroom practice; lack of awareness of research findings on the part of the teachers and their reluctances to accommodate such findings; and science teachers' tendencies to rely on personal knowledge in the practice of science teaching. To facilitate the impact of science education research on actual classroom practice, researches should be planned and conducted vis-à-vis the adoption of research areas that have potential usefulness to science teachers, and the development of strategies to improve teachers' awareness and willingness to adjust to research findings are discussed in this paper.

1. Introduction

Research in science education has begun to witness a commendable growth in the last two decades. Research findings from mathematics and science-related subjects/courses have been reported in several seminars, workshops, conferences, local and international journals, yet, the impact of these researches on classroom practice seem to have remain little, or somewhat unfelt as reflected by students' performance in the sciences in both internal and external examinations.

Researchers [5, 8, 10] have raised issues of research utilization and sought to find out possible reasons responsible for the widening gap between science education research and actual classroom practice. Kempa [5] observed that, the reasons for the lack of interaction between research and classroom practice include: (i) researchers have concentrated largely on the generation of research findings, and have given low priority to exploring their implications for, and application in the classroom. (ii) the choice of issues for research, undue attention given to fashionable research areas without adequate consideration of the practical usefulness of the research findings, or where the results of such issues tackled by researchers are often not those that teachers regard as important and relevant to their work.

The gap between research and practice is not peculiar to the secondary level of education, but also exist at the university level. In a study conducted on undergraduate education, Terenzini [10] found significant gaps between what research shows about how students learn and pedagogical practices. Smith [9] also noted a similar gap with respect to vocational education and training. The author stated that the linkages between research and its applications (in the form of educational decision-making) are *weak* and not as strong as it should be.

Empirical studies in this area are almost non-existent, although, occasional articles can be found in which opinions on research utilization are expressed. Apart from the reasons given above for the lack of

interaction between research and practice in science education, it is important to note that the teachers themselves have a role to play in the process of translating research findings from science education research into classroom practice. It is our intention in this paper, to discuss how science education research findings can best be translated for classroom practice, so as to strengthen the impact of research in science education research on actual practice.

2. The Lack of Impact of Research in Science Education on Classroom Practice

From the literature, researchers sought to identify possible reasons responsible for the discrepancies in science education research and classroom practice. Two particular positions identifiable in this context of science teachers' reactions and attitudes toward education research findings are that:

• Teachers tend to view most research findings as unrealistic, difficult to interpret, and rarely possible to implement [4] or that they simply ignore the findings from education research [5].

• Science teachers, and even experienced ones, are fairly unaware of the outcomes from science education research and they conduct their teaching in ignorance about research-based information.

Costa, *et al*. [3] conducted a small-scale study on the nature of science teachers' awareness of science education research findings. The study revealed that the knowledge of science teachers about research outcomes is generally very limited. The study further shows that science teachers regard personal experience or common sense as sound pedagogical knowledge. Though, such knowledge seems to be well-matched with research findings. The gap between research in science education and classroom practice is predominantly due to teachers' ignorance about the findings generated by research, rather than their rejection of such findings. The task to bridge the gap between research and practice should be an urgent task for both the researchers and the implementers of research outcomes.

3. Integrating Science Education Research Findings into Classroom Practice

The need to create awareness about what research findings in science education must be regarded as an important task in our service to science teachers in the secondary schools. Researchers have to convince teachers that the objectives, research-based investigation of teaching and learning has led, and is still leading, to the ways and manners the teaching and learning of science should be conducted in schools.
However, it is important to underscore that when teachers become aware of the outcomes from research, their awareness does not automatically translate into actual classroom practice. There are processes that lead from awareness to the application of such research outcomes in the teaching and learning of science. Where these processes are non-existent, teachers tend to reject the results from education research or view such findings as difficult to interpret and implement [7, 16]. Therefore, it has become imperative to discuss the processes involved in translating science education research findings into actual classroom practice.
Science educators have argued that this process of translating research findings into practical teaching is not too different from the curriculum diffusion process described by Cooper [2] for curriculum innovation, which is meant to lead from the generation of a new curriculum to its incorporation by teachers into their educational practice. Cooper suggested the following five phases as essential components of the curriculum innovation process:

- The teacher becomes aware of a (curriculum) project's existence.
- The teacher acquires knowledge about the project's philosophy, and the ideas and materials generated by it.
- The teacher makes limited use of the project's materials.
- The teacher adopts the project; this involves the acceptance of the project's philosophy and the extensive use of its materials.
- The teacher implements the project; he/she teaches it in full accord with the project's philosophy and with regard to his/her students' needs and aspirations.

It was argued that, for an innovation to have taken root, teachers must have, at least, made limited use of its ideas and materials. However, a project would not reach the highest level of impact, unless the teachers' operates at the implementation stage in the process. This necessitates the teacher to use the materials, adjusts and modifies them in accordance with the needs of the students, rather than merely applying them in a mechanical way [2, 8].
To adopt Cooper's curriculum diffusion process to integrate education research findings into classroom practice, we can also draw on the following five sequential phases that include:

- Teachers' awareness of research findings;
- Teachers' initial response to the research findings;
- Teachers' consideration of responding to them, having examined the research findings in some detail;
- The teachers' action, following the detailed consideration of the research findings under; and
- The degree of impact of the research findings upon classroom practice [6].

While awareness and familiarity with research findings are necessary conditions for its utilization in the classroom, they are not sufficient to bring about its effective application in the classroom. If teachers have acquired knowledge of particular research findings, they may show no interest in them or ignore them, in which case the findings will have no impact on practice.
Therefore, if education research findings are to find application in the practice of education, teachers do not only have to be conversant with the findings, but they must also take a positive decision to incorporate them into their teaching. While this does not automatically guarantee that the findings are fully implemented in actual classroom practice, we can at least, guarantee the different degrees of research utilization. These can range from teachers being aware of research findings and occasionally acting upon them to their full acceptance by teachers, coupled with a major adjustment of teaching procedures and strategies to reflect the research findings. In each of these situations we could claim that the research has an impact on classroom practice, though with a varying degree of impact.

4. Science Teachers as Researchers: Best Practice for Science Teaching

At this stage, teacher's knowledge of research findings is no longer adequate. Rather, it has to be merged with the teachers' pedagogical content knowledge if any purposeful application of education research findings in the practice of science education is to be achieved. This task is not what teachers can cope with. There has to be a decisive partnership between researchers and practitioners. This is in recognition of the fact that, each partner group has its own distinctive knowledge to contribute to the research implementation process.

The idea of 'the teacher as researcher' has gained some popularity as a possible and best approach to narrowing the traditional gap between research and practice in education. Researchers [3, 6] have reported findings where there has been a successful involvement of teachers in science education research and the dissemination of its results. Though, the impact of such teacher involvement in education research was somewhat felt and limited. The main reason is that teachers tend to operate within their own school. This obviously place limitations on the sphere of their influence.

To bridge this research-practice divide in science education, Kyle, *et al.* [7] emphasized the need for teamwork between researchers and teachers, and recommended that: research should be a complementary and collaborative endeavour between the teachers and researchers; the teachers should be action-researchers; and research must be, as close as possible, to the classroom.

We would like to underscore that teachers are most likely to find reliable, research outcomes arrived at, through a mutual effort of the researchers and teachers, rather than, results imported from studies they have little or no understanding about. In cases where teachers are involved in the generation of research findings, they are far more likely to apply them, not only because they were part of the research, but also

because the research is in their naturalistic environment of the classroom, which could lead to a closer connection between research and its applications.

5. Conclusion

In this paper, we have raised issues that bother on the need to bridge the gap between research and practice in science education; teachers' awareness and knowledge of the findings from research endeavours; and the idea of collaboration between researchers and teachers. As concluding comments, it is noteworthy that the immediate emphasis should be on the application of research findings. This requires a careful adaptation of such findings to teachers' circumstances, and it is in this respect that the researcher/teacher partnerships seem not only desirable, but also potentially valuable to translating research findings to actual classroom practice.

References

[1] Castro, F. (2000). *A investigação em didáctica e o conhecimento profissional de professores de físicae química: contributos para optimizar a sua articulação.* Master's Thesis. University of Minho, Portugal.

[2] Cooper, K. (1977). Curriculum diffusion: Some concepts and their consequences. *Research Intelligence, 3,* 6-7.

[3] Costa, N., Marques, L. & Kempa, R. (2000). Science teachers' awareness of findings from education research. *Research and Practice of Chemistry Education, 1* (1), 31-36. Retrieved from http://www.uoi.gr/cerp/2000_January/pdf/09kempaf.pdf

[4] Jenkins, E. W. (1999). Research in science education in Europe: Retrospect and prospect. Paper prepared for the 1999 European Science Education Research Association (ESERA) conference at Kiel, Germany. Retrieved from http://brs.leeds.ac.uk

[5] Kempa, R. (1995). Science education research: From theory to practice. In A. Hofstein, B.-S. Eylon, & G. Giddings (eds.), *Science education: from theory to practice*. Rehovot (Israel): The Weizmann Institute of Science.

[6] Kempa, R. (2002). Research and research utilization in chemical education. *Research and Practice of Chemistry Education, 3* (3), 327-343. Retrieved from http://www.uoi.gr/cerp/2002_October/pdf/10VolCont.pdf

[7] Kyle, W. C., Linn, M. C., Bitner, B. L., Mitchener, C. P., & Perry, B. (1991). The role of research in science teaching: An NSTA theme paper. *Science Education, 75,* 413-418.

[8] Olorundare, A. S. (2014). *Theory into practice: Beyond surface curriculum in science education.* The one hundred and forty-seventh Inaugural Lecture presented at the University of Ilorin, Ilorin, Nigeria.

[9] Smith, C. S. (1999). *The relationship between research and decision-making in education: An empirical study.* Working Paper No. 24, Centre for the Economics of Education and Training, Monash University, Australia. (Report is available on: http://www.education.monash.edu.au/centres/CEET)

[10] Terenzini, P. T. (1999). Research in undergraduate education: And never the twain shall meet? *Higher Education, 38,* 33-48.

[11] White, R. T. (1998). Research, theories of learning, principles of teaching and classroom practice: Examples and issues. *Studies in Science Education, 31,* 55-70.