

Current Research Issues in Science Education

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Abstract

In this paper, some of the current issues being addressed by researchers in science education in Australasia will be explored. The issues to be discussed will include : who does the research, what is worth researching, multiple positionings and the 'I' in the text, the ethics of data collection, our views of the teachers and students with whom we work, theoretical frameworks, communication of the findings to policy makers, and being a member of a research community.

Introduction

In this address, I would like to focus on some issues that I feel warrant consideration by those of us involved in doing research in science education. Some of the points raised are not new but nevertheless are worthy of a place in our professional debates.

The Purpose of Research

As a national curriculum developer from 1985-1989, I was employed to facilitate policy decisions on science education, ranging from whether to allow fresh human blood, which could be contaminated with hepatitis B or AIDS, to be used in classrooms, to which aims for science education should be the basis for a revised curriculum. The majority of these decisions were made without a research base and where a research base did exist, the implications of that research were often not acceptable to many in the science teaching community, the scientific community or the public (Bell, 1990, 1991). For example, there was much debate and letters to the daily papers about teaching science in te reo Maori, the teaching science in the contexts of the everyday worlds of the student, and the use of teaching approaches that take into account students' thinking. People unaccepting of some of the ideas being promoted in the development work, would often ask what research the notion was based on. But the research, if it was available, was often judged as inadequate (for example, self-reports from students and teachers) or inappropriate (for example, its British data and its different here). Policy makers often have a perspective to promote as a

servant of the government minister and look to current and future research to support that policy, not to make it.

Anecdote Two

Just after I had moved from the former Curriculum Development Division in the Department of Education to the University of Waikato in 1989, I was approached by a science educator from a College of Education to be interviewed as part of her masterate research. We had worked together as part of the revision of the then F1-5 Science Syllabus, which I co-ordinated, on a group writing a professional development guide for teachers on science education and Maori students. She wished to interview me about my views on science education and Maori students. I felt comfortable with her interviewing me as I thought we shared similar views on science education and that she would be sensitive to the way I saw things. I

agreed as I felt that there was (and still is) little documentation of the thinking of the curriculum developers themselves on aspects of curriculum development projects in New Zealand and that this was an opportunity to help record the voice of one curriculum developer. I was interviewed twice and received transcripts of the interviews.

I heard nothing more until sometime later when I was sent a copy of her completed thesis by way of thank you. The alarm I felt when reading the thesis is still with me today. The unease was not with her analysis per se, but with the use of my words and sentences, my voice, to tell a story I had never told, and in fact had even constructed when I was interviewed. While I had agreed to the interview to tell my story, the researcher had seen the interview as a way of collecting data to support her developing theoretical perspective.

The issue raised by this anecdote is whose story is being told in the research data and analysis? What is meant by the term 'ownership of the data'? To what extent do we co-labour in collaborative research?

Anecdote Three

On another occasion, I was interviewed on school-industry links by a contract researcher, who had been a colleague in the Curriculum Development Division in the mid-eighties. While I was sent a copy of the transcript to read, I was not sent the chapter in the book where the interview is discussed and segments from the transcript quoted. Last month I received a request by the researcher to have the audio-tape included in the Oral History tape Library in the National Library Archives. The tape would therefore be available for 'genuine' researchers, but who will probably be unknown to me, to access as a source of data in future years. I declined the offer to have the tape deposited in the archives for future use.

The issue being raised here is the validity of a researcher in the future using data collected in the past for a specific purpose, when they may not

know the interviewee and the contexts in which the data was generated.

Anecdote Four

Over the last three years, I have directed a research project on teacher development (Bell, Kirkwood and Pearson, 1990). In planning and carrying out the research, we have endeavoured to make the research collaborative, that is we as university researchers co-laboured with the teachers as researchers. We held a view of the teachers as being involved in doing the research, rather than having the research done on them. We worked with relatively large groups for this kind of research - 21 in 1990, 12 in 1991 and 11 in 1992. To this end, the teachers received a copy of their interview transcripts and, in 1992, a copy of the transcripts of the teacher development course sessions. They had the opportunity to alter the transcripts if they wished before the analysis began. The teachers also had an opportunity to read each draft data analysis and suggest changes before it was made public. On four occasions, the group met for a day or after school to specifically discuss the data analyses. Did it make sense to them? Is this how you would see it too? At other times, the draft analyses were posted to the teachers and their response encouraged. Over the three years of the project, only a half of the teachers have remained involved to the extent of attending feedback sessions on the draft working papers. The data analyses were never substantially challenged or discussed by the teachers and the only changes requested were small editorial changes to the transcript quotes to reword the colloquial speech or to 'tone' down a strong analysis statement. For example, changing a statement that read 'The teachers felt that..' to 'Some teachers tended to feel that..' Did this mean that we as researchers had told the teachers' story or did they not feel able to change the story once it was told by the university researchers? How much have we as researchers told the teachers story and how much of the data analysis reflects the researchers story? Or as is the case, in a mixture of stories, does one story dominate? Throughout the project, we talked with the teachers about a possible role of

a teacher as that of researcher. The teachers were encouraged to collect data from their classrooms, to reflect on it, and to formulate further questions for their research activities. However, the teachers tended not to view 'doing classroom research' in the same way as the researchers. The teachers found it more helpful to collect information to support their sharing of anecdotes, for example, to collect survey responses to illustrate in the sharing sessions what the views of electricity were held by their students. In what sense were we co-labouring if we had a different view of research and data collection?

Anecdote Five

Last year, I was approached by the editor of an international journal in

science education, to write a chapter on the area of multi and/or bicultural science education for a special issue on areas for future research. While I have a great interest in the area of language, culture and science education from research, curriculum development and personal perspectives, I did not feel that it was my story to tell. In the centre's masterate paper, the Maori and science education seminars are taken by two Maori colleagues - Elizabeth McKinley and Pauline Waiti, who are also masterate students. I approached Elizabeth and Pauline and asked if they would like to write the paper, with my help. They agreed and during the months of writing the paper, we had several discussions in on how to tell the story and for an academic audience which expects a certain style of communication and discourse. The resulting paper (McKinley, Waiti and Bell, in press) was their story, written in a style acceptable to an academic journal - a style that more reflects the way I as one of the authors thought rather than the way they as the story tellers told it. To what extent is their story communicated in the paper, when it is not written in the style they would tend to tell their story in? Or were we being sensitive to the different discourses and multiple positionings?

Issues

Who is best charged to make decisions about what research receives public funding?

What is worth researching to improve science education?

What research will best inform and support teachers?

How can we communicate our findings to policy makers?

Who does the research, for example, in science education for Maori students?

What is the validity when a researcher works in a different discourse and culture from the others in the research endeavour?

What is the reality of teachers as researchers?

Whose story is being told in the research data and analysis?

What is meant by the term 'ownership of the data'?

To what extent do we co-labour in collaborative research?

What underlies our decision making as researchers: statements of principles or a commitment to human caring?

What is taken as informed consent?
confidentiality?

What constitutes data? Do we as researchers need to consider data collected as private and public data?

What kind of research promotes the self-esteem of teachers?

Should an outcome of research be the empowerment of of the teachers and students involved?

How do researchers develop professionally? Do we have a community of researchers who honestly discuss methodological and ethical issues such as the above?

What is the validity of a researcher in the future using data collected in the past for a specific purpose, when they may not know the interviewee and the contexts in which the data was generated.

How much have we as researchers told the teachers story and how much of the data analysis reflects the researchers story? Or as is the case, in a mixture of stories, does one story dominate?

To what extent is the Maori story communicated in the language, culture and science education paper, when it is not written in the style Maori would tend to tell their story in? Or were we being sensitive to the different discourses and multiple positionings?

In science education research, there are multiple positionings, with difference discourses. There may be differences between the language used, who can talk, ways of talking, roles and what counts as knowledge. We can move around the discourses to get different thinking. Within one discourse our thinking is constrained. As a researcher, we need to move in the discourses of students, teachers as well as researchers.

Discussion

The above anecdotes indicate some significant events in the research activities I have recently being involved in. They serve to introduce you in part to me so you know a little of where I stand and come from, but also to introduce a number of issues which I and colleagues in our research centre are discussing. For example, a doctoral student has been discussing her plans to interview me along with other women as part of her doctoral thesis on a feminist science education. The discussions we have had have included reflecting on the above anecdotes as well as thinking about the factors she would want to consider in collecting interview data. In this section, I wish to further discuss these notions that form apart of these on-going debates- those of who does the research, confidentiality, privacy, informed consent, empowerment and ownership of the data, and a community of researchers who are prepared to discuss problems as well as good results.

However, as the research progressed, I became increasingly uncomfortable with the process itself and the ethics involved. Firstly, the ground rules which I encourage my own students to use when collecting data by interview were not followed. The purpose for the research was not made explicit and I had to ask if a copy of the transcript would be sent to me. I put these concerns aside as the person was learning to be a researcher and I felt I wanted to be supportive. When I received a copy of the transcript, it was

not complete and the formatting and image printing as of a poor quality. There were gaps in my account, and as one of the reasons for my agreeing to be interviewed was to document my thoughts behind the curriculum development, I contacted her and suggested that we talk again so that she could get more details. This happened and much later, the second transcript arrived, with the apology that she had lost the tape.

ework, theoretical frameworks, still a place in our professional debates. This debate on research issues was noticeably absent from the 1992 conference of the Australasian Science Education Research

Association.' The issue that needs reflection on is 'what is the purpose of research in science education?'. One purpose is to raise the public awareness of findings in science education, for example, the research in the 1980's into children's science and alternative frameworks

Times and the research into just what the students were learning (or not learning) in practical work.

In this paper, I wish to discuss two broad issues:

- what is the purpose of research?
- whose story is it?, at the time

make science education problematic. F, helped raise teachers, teacher educators, politicians and parents awareness of some problems in learning in science education. I would see such research as falling into the category of fundamental research.

Another purpose is to evaluate current science education policy. The research findings gave rise to theory development, for example, in the areas of learning in science. Such research was characterised by much of the evaluation of the ASEP curriculum package in Australia in the 1970's. Both kinds of research are important for developing our understanding of learning in science but each can be seen to have a different roles.

However, the issue becomes more sharply focussed in the current climate of changes to research funding.

and politicians, and to possible solutions, for example, new classroom activities government in science education and the learning outcomes by students. Both contribute to future thinking and practice in science education and to policy making. For example, policy makers often have a policy, decided on by a , to develop may or refine political decisions Teachers and science educators may wish to change government policy and seek research findings that indicate the weaknesses of the policy and possible alternatives., not to make them highlight problems which suggests Hence, our research findings can be communicated to policy makers directly in terms of critiques of current policy initiatives or indirectly through people involved in science education advocating change. in terms of future directions for science education This In New Zealand, the former Department of Education and until recently, the new Ministry of Education funded both types of research, for ex the Learning in Science Projects at the University of Waikato and the

analysis of the responses to the consultation on the draft F1-5 Science syllabus. There is now a movement for the Ministry of Education to fund operational research, that is, the evaluation of government policy, and the newly established Foundation for Research in Science and Technology to fund other research, in this case, the research which could be classified as fundamental research. There are however, indications that the proportion of funding from the FORST money to social sciences is small. Some of the points raised are neither unique to science education, as of learning decision into policy. The issue here is ensuring the continuation of both kinds of research and the issue for example, of the proportion of funding awarded research. There is a concern that some research will fall between the two funding agencies. For example, action-research on new teaching activities that take into account students' thinking, may not be classified as fundamental research by FORST and yet may not have a high priority in current government policy in science education, alongside of such concerns as a science education for gifted children. And yet such research has been seen by teachers as valuable in improving their teaching and learning by their students (Bell, 1992). but with an action-research mode, it was often applied research as well.

For example, the research done by the team at the University of Waikato into students' learning in the early 1980's contributed to the development of a constructivist view of learning. An implication of this view is the contextualising of the learning of science in familiar contexts, to help the students make links between what they already knew and the new ideas presented in the science lesson. Contexts for learning science were a major feature of the curriculum debates surrounding the development of the F1-5 science syllabus in New Zealand in the mid-1980's (Bell, 1990, 1991).

Contexts have continued to be included in the 'new' curriculum document (Ministry of Education, 1992). Research into learning science in context (Rodrigues, in preparation) continues to explore and evaluate this current thinking in science education and current government policy, as well as contribute to our understanding of the learning process.

The issue today of both kinds of research is small (NZARE). Whose Story is it? Acknowledgements

I would like to thank my colleagues in the Centre for Science and Mathematics Education Research for their comments on an earlier draft of this paper presented in the weekly seminar series, and in particular to Andy Begg, Malcolm Carr and to Jane Gilbert, whose challenges have fuelled

my thinking. The changes in the structure and functions of the Ministry of Education in New Zealand has implications for the purpose for which it funds research, what is researched and how that research is done. This is of concern to me as a researcher. To what extent did we co-labour in the collaborative research? Throughout the three years of the project, I have also had an increasing sense of wanting a reciprocity to be a part of how I as a researcher do research. write the paper, with my help.

As raised by these are when quotations are used to support the data analysis. And collaborative research in the sense of co-labouring on the research questions in the funding contract, seems no longer enough. For me, there

needs also to be an element of the teachers working with me, being empowered. But what do the teacher and students) perceive as empowering? The theoretical analyses constructed from the data? The resources and new teaching ideas discussed as part of the research? A confirmation of their own views on science education by a university researcher and the confidence that gives to enter into school, local and national debates? I not think that the Code of Ethics (NZARE, 1981) to protect the 'rights and welfare' of people involved in the research, seems empowerment of (goes far enough. It is not just a question of proection from adverse effects, but that our partners in research should gain from the many hours they put into the research. and increased self-esteem the teachers. t And gain in a way that is meaningful for them and not just from a researchers point of view. In a recent article, Nancy Brickhouse (1992) discusses the notion of research ethics being based on caring rather than on just principles. In the research on teacher development, this perspective has given rise to a review of the notions of confidentiality and informed consent. For example, the notion of informed consent

If our ethics of doing research are based on caring, what is taken as informed consent? and confidentialiaity? transcripts of the interviews?

The Ethics of Caring

a concern being raised indirectly by some of the teachers involved in the research is the confidentiality of their interview transcripts. The teachers have spoken at length to the researchers, often in a one-to-one situation. In this seemingly private situation they have spoken honestly and openly about their views of teaching and learning, curriculum and schools. This data is then made public, with their consent, in the reports. Each teacher has been given a code and no names have been used in the reports. However, Hamilton is a small science education community, with only fifteen secondary schools in the area. the lengthy transcript quotations often give contextual clues and a style of talking that could identify a particular teacher. At the onset of the research, confidentiality was more of a personal issue Tidentalty was not a serious issue, with some teachers consenting to their names being used in the text and quotations and with their names and schools being listed in the acknowledgements. Now, as the project draws to a close, bulk funding of teachers' salaries is a reality for some Waikato schools. The salary of an individual teacher may be determined by the School Boards of Trustees. The quotations which were given consent by the teachers to be made public in reports, may now count against a teacher given the staff appraisal crtieria being developed. wo teachers have expressed concern that t, which they had given reports, may now count against them Is it ethical to publish the transcript quotations, without the teachers' consent? To what extent is it ethical to make public data and data analyses that have not been consented to by the teachers and students who generated the data?

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