DEVELOPING NOVICE RESEARCHERS UNDERSTANDINGS OF RESEARCH

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Abstract

This paper reports progress from an action research programme to develop an active research community amongst New Zealand computing educators. Since 1998 the National Advisory Committee on Computing Qualifications (NACCQ) has sponsored a number of "Getting Started in Research Workshops". Topics addressed in the workshops have included definitions of research, the maturity profiles of researchers and the nature of research conducted under different research paradigms. The workshops have developed from an initial educative and developmental focus for novice researchers, to one that now embodies more of a critical perspective, in which participants reflect upon and collectively discuss their own beliefs and understandings as educators and researchers within the NACCQ sector.
This has required the development of specific self-assessment instruments. These include an instrument for assessing researcher maturity and a further instrument for self-assessment of paradigm preferences in curriculum development and research. Preliminary results from these self-assessments have been reported (Clear & Young, 2001) which give some insights into the understandings about research of computing educators and novice researchers in the sector. But developing and refining these self-assessment instruments is a continuing process. Since this self-assessment process has been undertaken as a means of actively modelling use of the critical method in research, determining forms of analysis that are consonant with this paradigm is a current issue for the authors.

This paper will discuss the context, the instruments developed, review the issues related to analysis of data gathered to date, and indicate future directions for this research.

Introduction

The NACCQ (National Advisory Committee for Computing Qualifications) as a subject forum of the Association of Polytechnics in New Zealand (APNZ), is a national coordinating body for the computing curriculum in the former polytechnic sector. More recently as the sector has evolved into a composite of local degree granting institutions across the higher education sectors, the role of the NACCQ as a professional development body has grown. The research reported here relates to the nature of the new researchers within the sector and their understandings of research. New tools and techniques have had to be developed to elicit these understandings in a conscious and self-reflective manner, and contribute to the development of an emerging research community that is self-aware and confident in character.

Background

With the move to degree level programmes and a context within which the majority of academic staff have come into the sector from careers in the private sector with limited, if any, research experience" (Sylvester, 1997), there was a need to establish a research culture. As evidence of the degree of change, over a span of less than eight years, 17 of the 24 NACCQ sector members have now become involved in the provision of computing degrees. Since 1998, NACCQ has conducted six "Getting Started in Research" workshops for educators in the NACCQ sector, as one initiative to generate this awareness.

Settings

It is from last three of these workshops that the data reported here has been gathered, as a set of anonymous and voluntary contributions from participants. Subsequent to the workshops we have conducted two further local sessions. In June of this year this data has been augmented by an international dataset from a group of computing educators at the Association of Computing Machinery (ACM) Sponsored Innovation and Technology in Computer Science Education conference In Canterbury UK. A further presentation and data collection exercise was recently conducted in October 2001 with computing educators at East Tennessee State University. For this presentation the instruments were revised to more clearly indicate the reasoning behind a respondent's choices, and thus better support international and between group comparisons.

The Research Process

The research reported here occurs within the context of a loosely framed action research (AR) programme sponsored by the NACCQ Academic Quality and Support Working Group.

Carr & Kemmis (1983) distinguish three distinct kinds of action research: technical, practical and emancipatory. Technical AR could be regarded as a form of consultancy or active field study led by an expert researcher to achieve externally imposed goals. Practical AR aims to improve the practices of individuals or groups of practitioners, and to contribute both to practitioners understandings of their practice and of the situations in which practice occurs. The facilitator in practical AR encourages "practical deliberation, while systematically transferring ownership of the method of self-reflection to participants" (ibid.).

"Emancipatory AR by contrast shifts responsibility for practice and the action research process to the participant group. In this case the group takes joint responsibility for action and reflection". This form of AR "incorporates a social perspective…provokes a critical response to organisational constraints…and aims at a transformation of the organisation and practice of education." (Carr & Kemmis, 1983)

A key mechanism in an action research model within an educational context is the concept of reflective practice Argyris & Schon (1974), (Schon, 1987) in which professional work involves an ongoing process involving self monitoring, continual improvement and action cycles (plan, act, observe, reflect).

Towards Self Confident Practice Communities

This paper results from a reflective cycle within the NACCQ sector's programme of research capability development. A summary of the research programme is expressed below in terms of the McKay & Marshall (1999) "elements of an action research intervention". While the research method may be somewhat "retrofitted" upon a practice improvement initiative, it does accurately frame the research process being undertaken, and acknowledges the evolutionary nature of the action research process.

Element	Description
F (Framework)	Reflective Practitioner Model (Argyris & Schon, 1974, Schon, 1987) Emancipatory Action Research (Carr &Kemmis, 1983)
M_R (Research Method)	Practical Action Research, (Loosely framed), combining some elements of Emancipatory Action Research?
M_{PS} (Problem solving method)	Practical Action Research, educative workshops, reflective critique
A - (problem situation of interest to the researcher)	• What should be the nature of research in the NACCQ sector, and how can it be enhanced? • What is the nature of researchers in the NACCQ sector and how can they become more effective? • What is the nature of the research culture in the NACCQ sector and how can it be enhanced? • What is the nature of researchers in the NACCQ sector, as opposed to other professional educators?
P - a problem situation in which we are intervening	• Developing and maintaining NACCQ sector degree level teaching quality • Developing NACCQ sector educator capabilities in research • Developing NACCQ sector research culture and community • Supporting a movement away from a perceived undue emphasis upon the Functional paradigm by former Diploma teachers in their degree teaching,

Table 1: elements of an action research intervention – NACCQ sector research capability development

In an emancipatory AR model this work might be part of developing a self-sustaining, enlightened, and assertive community of researchers within the NACCQ sector, promoting a new set of stories and insights in a distinct and vibrant model of New Zealand research. But, at this stage this research should be classified under the "practical" rather than the "emancipatory" AR category.

Instruments

Researcher Profiles

A number of instruments have been developed to support this work. The first instrument serves to profile researchers within a maturity continuum. The initial instrument depicted in Appendix A had a six stage scale of research maturity.

From experience with participants in the workshops, this initial instrument was revised and some of the items moved between stages, for instance invitational chapters from level 5 to 6. Acknowledging the growth in research maturity of the participating institutions, with the addition of postgraduate programmes and professorial positions, a further stage was added to the instrument, shown in Appendix B.

Curriculum Development Paradigms

In their self-assessment participants used an instrument developed from an original by Melrose (1993), which assessed professional educators' beliefs in such areas as curriculum development and educational leadership. For new researchers the "curriculum development" instrument seemed a useful starting point to establish a common base of understanding. To this was added a new instrument with categories defining paradigms for research. Participants were handed out instructions in how to use the self-assessment tool. Melrose's (1993) clues for identifying the paradigm code for curriculum development were incorporated in the combined instrument, followed by the clues developed for research as shown in Appendix C.

Data Analysis

Several issues arise during analysis of the data resulting from this work. Key among these are:
- the nature of the data gathered,
- appropriate treatment of data collected as part of a personal and self-reflective activity within an interpretive/critical paradigm
- limitations and appropriate use of anonymous survey data,
- grouping of results of data gathered at the individual unit of analysis,
- feeding results back to inform further action by the original practice communities.

Nature of data

The data was originally provided as nominal data in a text coded upper case or lower case letter. This was recoded to ease the analysis process of elucidating and depicting significant patterns.

Appropriate treatment of data for the operative paradigm

The interpretive nature of the instrument as a means of personal evaluation and critical reflection means that some caution must be exercised in subjecting it to the type of analysis normal in positivist quantitative research. For instance the tests for rigour differ in each paradigm, so that the implications for such measures as "construct and content validity", or "instrument reliability" need careful assessment (cf. Boudreau, Gefen et. al. 2001, and Klein & Myers, 1999).
More importantly the very step of aggregating results to address the question from table 1 "What is the nature of researchers in the NACCQ sector, as opposed to other professional educators?" has the potential to misdirect the research programme.

Previously the view of the authors had been that, "The value of the instrument as a technique for reflecting upon ones own practice was borne out by an attendee at the third workshop who had also attended the previous one. She noted that her perspective had changed in the intervening two-month period and upon reflection her answers now differed from those she had originally given. Likewise an attendee at the fifth session, had conducted the exercise previously and now felt she had a much clearer grasp of the distinctions and was able to reflect upon the progression of her own practice as a researcher."(Clear & Young, 2001) Feedback from the East Tennessee presentation has helped reinforce the true value of the instruments, as educator/researcher self-assessment, and practice-community development techniques. The role of the workshop process and the use of these instruments has been to demonstrate the value of identifying and making explicit for practitioners the contradictions between their teaching beliefs and their actual approaches, and the contrasting distinctions between their beliefs about teaching and those about research.

Limitations and appropriate use of anonymous survey data,

Given the anonymous nature of the survey data collected, a fuller analysis that better interprets the meaning of responses is lacking. For instance the degree to which a paradigm choice is constrained by external factors (e.g. national curriculum) as opposed to personal preference is not clear.

Grouping of results of data gathered at the individual unit of analysis,

Likewise group level analyses of individual data items may not be valid. For instance indicating that a group of educators are primarily functional in their teaching styles when they teach across several different programmes, disciplines or sub-disciplines and levels, some with externally mandated curricula may simply average out distinctions, which need to be specifically identified.

Feeding results back to practice communities

Again, in relation to the chosen research paradigm, the original aim of this research was to assist individual educators to actively reflect upon their teaching/research beliefs and thereby build a stronger research community within the NACCQ sector, in which their research acted to inform and support their teaching on degree programmes.
Having collected data and compared communities (Clear & Young, 2001), what is the appropriate means of feeding that back directly to the research communities themselves, and what outcomes should result? What paradigm should be operative and who should determine this? Given the anonymity of the original contributors, reconstituting these communities could be somewhat difficult.

Future Directions

At this stage in the research the authors are taking stock. Two important questions come to mind:

- What now is the research question?
- Why is it important?

While following the interest in comparing the participant groups to identify distinctive characteristics a number of possibilities arose.

Following up an initial option involved augmenting the instrument with one that required respondents to identify the top three key phrases, which had guided their choice of a paradigm.

A second option involved developing tentative hypotheses for investigation, based on observations about computing educators tending to favour functional teaching paradigms, and non-computing educators favouring critical paradigms to a greater degree than computing educators.

Hypothesis:

> Computing educators prefer different teaching and research paradigms than other professional educators

A third option could involve revisiting the original participants and conducting individual interviews using phenomenographic methods to gain richer insight into their personal feelings, beliefs and the contexts that shaped them. This would require a formalised research programme with full human subjects ethics approvals.

A fourth option, as an extension to the research could involve redeveloping the instruments for IT practitioners, to enable them to assess their primary practice paradigms, and the implications for their practice. A draft set of instruments is now undergoing testing.

A fifth option, remaining true to the critical perspective in this research could involve jointly negotiating a future direction for this research that recognises the desires of the involved research communities.

Conclusion

One conclusion that now seems apparent is that options 1 –3, taking a more functional perspective, even if triangulated with interpretivist data, have the potential to misdirect the research from its original goals, do not exploit the strengths of the work to date, and are not particularly productive avenues to pursue. Remaining true to the original concept of developing self-aware researchers and practice communities is a good informing principle for future research directions.

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RESEARCHER PROFILES (Initial)					
1	2	3	4	5	6
Not interested Do not perceive research as part of the academic role	Cognisant of the need for research but unable to translate ideas into publications Unsure of what to investigate and to write	Forms or joins teams of researchers (max 4) to stimulate ideas, provide motivation, guidance and manuscript checking Conference attendance, initially not as a presenter but to observe, then with confidence as a presenter	Submitting papers, initially to professional magazines and writing product, performance or book reviews Writing for refereed journals Becoming fully acquainted with the full body of literature and fellow researchers Book Preparation	Establishing research objectives and conducting discrete research projects Maximising student contributions receiving organisational support Invitational chapters International recognition and collaboration	Undertaking more extensive research programmes, Providing significant contribution to the field Attracting external funding International reputation Organisational recognition

Table 2. "Researcher Profiles" McDonald G. (1998).

RESEARCHER PROFILES (Extended)						
1	2	3	4	5	6	7
Not interested	Cognisant of the need for research but unable to translate ideas into publications	Forms or joins teams of researchers (max 4) to stimulate ideas, provide motivation, guidance and manuscript checking	Submitting papers, initially to professional magazines and writing product, performance or book reviews	Establishing research objectives and conducting discrete research projects	Undertaking more extensive research programmes,	Contributes to Policy making from institutional, to international levels
Do not perceive research as part of the academic role	Unsure of what to investigate and to write	Conference attendance, initially not as a presenter but to observe,	Writing for refereed journals	Maximising student contributions	Providing significant contribution to the field	Leads national and international teams of researchers
		then conference presentations of posters and concise papers	Becoming fully acquainted with the full body of literature and fellow researchers	receiving organisational support	Attracting external funding	May establish or head a research centre
			Conference presentation of refereed papers	International recognition and collaboration	International reputation	Book preparation
					Supervises Postgraduate student research	Has an extensive publishing record
					Invitational chapters	Mentors research colleagues to initiate and develop research programmes
					Organisational recognition	

Table 3. Revised and Extended from "Researcher Profiles" McDonald G. (1998)

Instructions:

1. Read the descriptions of the three different models in part 1 of Melrose's Appendix. Consider your own beliefs and practices. Construct your own individual code for curriculum development and write it in the table below. You may use between 1 and 3 letters for your code. Each letter may be capital or lower case.

Use: F or f for Functional
           T or t for Transactional
           C or c for Critical

Note:

There are no correct answers. People have constructed many different codes, e.g. T or fTc belong to people with a similar outlook but the second person switches from one model to another at times (depending on context) while still preferring a transactional approach.

2. Move on to construct your code(s) for part 2 (research) and add them to the table.

Area of Practice	Code	Comment
1. Your curriculum development	☐	
2. Your research	☐	

Table 4: Curriculum Development and Research Codes

Clues to identifying the code

Part 1: for curriculum development

- **Functional:** Is set in the present. Fits what the industry or society needs now for that person to take up that job. Reproductive. Technical. Task and skills-based for a specific occupation. Content of subject area is very important. Has objectives that are often set by an external body or an industry group with some input from teachers. Sometimes referred to as practical. Methodology often involves set lectures and teacher-directed demonstrations, workshops or laboratories.
- **Transactional:** Based on the needs of the individual students or group who happen to be doing that course. Often transferable skills are involved. Process – rather than product - or content orientated. Negotiated objectives and criteria (for individual and/or group) evolve. Methodology often involves facilitation of group discussion. People centred. Student centred. Experiential learning is valued. Democratic.
- **Critical:** Based on predictions of future needs, visions of a better, fairer world. Education for the future is a focus. Learning to learn is important. Developing critical thinkers is a goal. Methodology often involves teacher asking critical questions, shaking previously held beliefs, querying current systems, acting as change agent, emancipatory. Objectives are often broad.

Part 2: for research

- **Functional:** the researcher operates as an objective expert observer, seeking to discover new knowledge by developing and testing hypotheses. Participants in the research are passive or directed subjects. The goal of the research is to discover new knowledge, theories or rules, which have universal applicability. **Typical methods:** *quantitative*, hypothetico-deductive, surveys, experiments, statistical analyses (e.g. regression analysis, factor analysis, simultaneous equation modelling).
- **Transactional:** the researcher operates as an expert interpreter, but acknowledges that research subjects have their own perspectives which may be interfered with by the researcher's presence. The goal of the research is to generate insights from the lived experience of the research subjects. **Typical methods:** *qualitative*, case studies, phenomenology, unstructured interviews, ethnography, narrative enquiry, grounded theory.
- **Critical:** the researcher operates as an agent of enlightenment or active change. The goal of the research is to uncover oppressive forces and restrictive conditions, which may not be apparent to the research subjects. These conditions may be illuminated and shared with the subjects, or the researcher and subjects may jointly negotiate goals and work as co-researchers to change the status quo. **Typical methods:** *evaluative*, critical ethnography, critical action research or participatory research, dialectical hermeneutics, critical theoretic.