Exploring the what and why questions in Technology Education Research and Research Training

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This paper examines changes in technology education research and educational research more generally over recent years and the implications for technology education researchers and research training. It does this firstly through an examination of a number of recent developments in research technology. It then argues the case for greater use of combinations of qualitative and quantitative methods to provide more comprehensive and more believable answers to the kinds of questions being posed by educational and research bodies. The paper then describes a postgraduate research methods course that has been incorporating these approaches over the last three years and draws some conclusions about the key features of such courses.

Introduction
Educational research is undergoing significant change, with not only increasing pressures for the delivery of research outcomes on increasingly complex issues but also a greater demand by the users of research for researchers to deliver quality evidence-based research to support future decision making. This change was a central theme of the book on technology education research methods edited by Middleton (2008). Thus, current researchers and the emerging post graduate researcher are entering a very different work environment that calls for greater capacity to do research and greater flexibility and depth in their research skills.

As well as the changes in terms of the demands on research quality, the last thirty years has seen a move away from a dominant focus on quantitative methods using statistical analysis to more widespread use of qualitative methods, that support greater understanding of participants through naturalistic enquiry (Creswell, 2012) with interpretive/hermeneutic approaches advocated (Onwuegbuzie and Leech, 2005). One unfortunate by-product of the change has been the emergence of what might be termed the qualitative/quantitative divide. Salomon identified the problem in a 1991 paper and argued that quantitative and qualitative methods could and should complement each other and that thinking about them as being competitors was unhelpful. Salomon went on to argue that complementary meant more than just being allowed to exist together. Salomon argued that each could both inform and guide the other and in doing so, improve the quality of the research outcomes that result from their complementary use. Salomon argued that a better way to describe methods was to use terms like analytic and systematic and explains:

Our controlled experiments show that computer tools can offer the learner a mode of thinking that can be internalized and hence can provide at least one theoretical and empirically based rationale for their inclusion in the classroom. On the other hand, our systemic research suggests
that the attainment of any worthwhile effects by the inclusion of computers necessitates the redesign of the whole learning environment. It also suggests that once this is done, the relations of attitudes, abilities, activities, perceptions, and social relations with respect to achievement totally change in important and differential ways. No analytic study could have shown that. This, in turn, suggests new questions and new hypotheses, some of which need perhaps to be addressed by analytically oriented studies, or possibly by research that is guided by yet another paradigm. After all, the analytic approach capitalizes on precision while the systemic approach capitalizes on authenticity. But none is particularly good as a basis for generalization.

(Salomon. 1991. Page 16)

A contemporary example to illustrate the utility of mixed method approaches is the study by Walmsley (2008). Walmsley wanted to explore the factors that led to classrooms where higher-order thinking was an outcome of the learning process. However, before examining classroom interactions, Walmsley had to be able to identify classrooms where higher-order thinking was being exhibited. Walmsley used a quantitative instrument called the Cognitive Holding Power Questionnaire (Stevenson, 1998). This is a survey that can be administered to whole class groups and provides valid and reliable data on student thinking that can be analysed statistically.

After administering the survey to a range of classes, Walmsley was able to select those classes scoring high on higher-order thinking and then use a qualitative method employing video stimulated recall techniques to establish why these classes were engaging in higher-order thinking. Thus, not only was the research improved by the use of mixed methods, it would not have been possible to undertake it without the combination.

As we are teaching students how to do educational research we must prepare them for the field – and the field is increasingly using mixed methods research. Thus Ivankova & Kawamura (2010) note that from a systematic literature review searching for the use of studies published as “mixed methods” there was an increase from 10 in 2000 to 243 in 2008, with the increase particularly rapid in recent years.

New Technologies

In addition to changes in the demands of those who fund and use educational research there have been changes in the kinds of technologies available to researchers. There are many of these but for the sake of this paper, only three will be used to illustrate the point. These include text-analytics, on-line surveys and video-data.

Text-analytics provide a mechanism through which textual discourse can be transformed into a more formalized structure that can directly aid the determination of valid and reliable conclusions, and also help identify subtle connections that would easily be missed in manual approaches (Edgington, 2011). The market for such products is rapidly expanding with one tool we use (SPSS Text Analytics for Surveys) supporting more reliable analyses and presentation of data such as extensive open responses in surveys.

On-line surveys have resulted in two advances in educational research. Firstly, they allow researchers to access much larger samples at little or no cost beyond their labour in constructing the surveys. Secondly, they have proven to be a source of very useful qualitative data. That is, most surveys include a section for comment after questions requiring ranked responses. With paper-based surveys, these traditionally provided little
useful data and were often not completed, however, researchers (e.g., Yun and Trumbo, 2000 and Klieve et al., 2010) are finding that on-line survey participants are happy to provide quite detailed responses to these general questions. In addition, as participants feel secure in their anonymity with on-line surveys, they are providing responses that are regarded as having high levels of validity with Kiesler & Sproull (1986) suggesting that respondents will become relatively unconcerned with social norms and the impression they give others.

Equipment for capturing and analysing teaching and learning activities has extended the utility of methods such as stimulated-recall (Meade & McMeniman, 1992). In the study referred to above, Walmsley used a system of two video cameras that were synchronised and recorded to DVD in parallel to capture the activity of both the teacher and students in a learning activity. Walmsley was able to examine the parallel data to achieve a fine-grained analysis of the nature of the interaction between teacher and student and between students.

Research Training
The changes in the demands on educational research, the qualitative/quantitative divide and the availability of new technology provide the context for the informal action research project undertaken by the authors over the last seven semesters. The study was also informed by the belief that rigorous educational research was important and that the next generation of educational researchers needed to undertake research methods courses that left them with skills in a variety of qualitative and quantitative methods and equally importantly, the confidence to undertake research. Thus research preparation is regarded as an opportunity to prepare not only for the immediate research activities in postgraduate programs, but should be viewed as a “research apprenticeship” in which emerging researchers have the opportunity to hone their understanding, capacity and also their motivation for research.

This paper takes examples from those enrolled in formal research methodology training, students with whom the authors worked with through this process. The observed processes and experiences provide insights into their learning processes and also how the interactions between undertaking quantitative and qualitative components of a study can provide real synergies in the research process, adding to the thinking processes and particularly to the possible outcomes of such research.

Reconceptualising research training
This paper suggests the need for a reconceptualization of the role such courses can play, moving from the identification of tools for future use, whether quantitative, qualitative or a broader mixed methods perspective, to a more complex appreciation of the different tools and the role they can play in developing our researchers capacity to work in their craft. As a part of this approach, we examine how emerging researchers can develop, through emerging experience, an appreciation of the critical links between the research question they ask, the methodology through which they select to answer and also the opportunities through which further dimensions of this question might be addressed, with an awareness of the links to other research questions and strategies.
The course used for this study is that offered to Master of Education students. This was selected as it had both the greatest participation (run each semester with enrolments of between 25 and 40) and was also the most practical with all students undertaking two small pilot projects. The course is also offered in both on and off-campus mode and has a mixture of domestic and international students.

**What was our starting point?**
There were a number of ideas that informed the setting up and conduct of the course. They were in part determined by the composition of the student cohort, which is always diverse in terms of prior experience, cultural background, age, employment and confidence. Our response to this diversity can be described in terms of the learning environment and approach, course content and organisation, and course structure.

**The learning environment and approach**
The approach adopted in the courses was intended to be more one of a collegial learning environment than a formal classroom. Thus the lecturers, while coming with more experience, and also providing the significant content material to the group, adopted a participative and facilitative approach that recognised that they provided but part of the input, with significant learnings also coming through group interactions and individual learnings and prior experiences.

The underlying approach was about learning to use the appropriate means for finding evidence to answer or respond to a research question.

**Course content and organisation**
The course content, focussed on research processes, methodologies and also research output genres (reports and proposals) was run in parallel to the practical research activities being undertaken. For example, students are involved in a weekly 2 hour session. For each session an initial lecture/discussion was followed by a coffee break then a less formal tutorial session in which progress on the practical tasks was discussed. As the leaders of this process we may have a lot more experience than those participating, however, it provided a valuable insight to students to be aware that we also acknowledge that we are also learning. It is formally recognised, and regularly demonstrated that much of the learning in this course comes from the comments of those participating. As one student recently commented

> Your teaching style had enabled me to grasp new concepts and it has been wonderful sharing the journey with our diverse group

This process, while relying on the involvement and interactions of students does not appear to be reliant on a “good cohort”. This format has been repeated for the last seven semesters with similar interactions if not very different groups and dynamics. There has been a generosity of spirit by many students, being prepared to share their ideas and learnings – while often learning at different levels. But because all participants are doing their own topics there is less of a risk of having to protect ones own ideas – we are not playing a zero-sum game!

The underlying element of our approach is trust that participants feel that they do not have to protect their ideas in case they are judged. But discussions start at the very basic level. What topic are you interested in?, then moving on to designing the survey and
collecting responses. In addition, there are extensive discussions within the group in parallel to similar email level discussions with the lecturers assessing responses and giving the OK for progression. However, an interesting learning that we regularly discuss is getting a feel of what is possible to achieve and learning to scope a bit more realistic. Often we have students who have quite extravagant expectations of what can be achieved through research, even with very small research projects. Thus a significant learning for most students is to recognise the link between the research question and the method through which this can be addressed and in the process developing a better feel of what is possible to achieve.

One of the challenges for students moving into research is understanding what it is they are actually learning. Unlike many subjects where there is clearly defined content, methodology courses instead are really aiming to introduce students to the practice of research. This can be “learnt” through a number of interrelated strategies including:

- Becoming involved in the literature and placing one’s own research “in it”
- Planning a real research project
- Undertaking research
- Reporting on research

But these activities are largely formative providing a base for the real learnings, which we consider to be the readiness to enter and undertake more active and independent research practice. Perhaps the real things we are seeking for people to learn is an appreciation of the research process, a recognition of what is achieved, and most importantly to develop the confidence to ask questions, to feel confident in the research environment. These are practical outcomes generally from experience and thus a simulated, or managed research experience provides an effective means for helping students to teach themselves such aspects through their experiences. One of the exciting demonstrations of this learning is students identifying the next stage of their project – of further research questions that emerge from the initial step of research.

The approaches for this can range from the strongly theoretical to the practical – but all work with the intention of preparing students for becoming involved in research – whether predominantly as a researcher or a user of research.

**Lightbulb Moments**

One of the major differences between standard coursework subjects and those such as discussed here, where students are undertaking the practice of research, is that there is a shift from learning the known to exploring and appreciating the unknown. A common situation we have found is students who express great concern that “but that's not what I expected” The surprising but critical learnings for them is that this is good, that this might be where you find something new, open an opportunity to greater understanding. And the value of our teaching approach is such events are able to be captured and shared – thus in a class this may only happen once during a particular semester, but because of the sharing nature of the learning, all students are able to capture the benefits.

**What did we find?**

For this next section we describe the things that evolved over the course of the seven
semesters and how our students responded. We have described these in terms of structure, confidence, practical learning, finding a niche, and becoming an educational researcher—themes identified from comments provided through the confidential student course evaluation process.

**Structure**
A common approach to teaching research methods is to provide an introductory overview of research and research methods followed by two modules focusing on quantitative then qualitative research—with a final session discussing the mixed methods experience that has been undertaken. We initially reversed this order, teaching the qualitative methods first. We did this on the basis that education students would find the qualitative methods provided a gentler introduction prior to the quantitative methods. This worked reasonably enough, however, for a variety of reasons, we decided to reverse the order and teach the quantitative methods first. This provided unexpected benefits for student learning because the quantitative practical involved a small survey. Students found that the analysis of their survey data provided an issue they wanted to explore in their second practical task which involved an interview. Thus in planning the two research tasks a mixed approach is modelled. Students also frequently find this an appropriate way to write up the second, explanatory study with reference to the original quantitative results.

I liked the way that the content and assessment items were lined up. I appreciated doing the quantitative project first as it is more structured and makes the second project somewhat easier to deal with.

**Gaining Confidence**
Students are very familiar with reading texts, but undertaking research is not something that can be entirely done by formulae. There are many judgements and decisions that need to be made and timelines to be managed and generally real people to work with, as subjects colleagues or collaborators. Thus, there are a lot of unpredictable elements which takes students outside their comfort zone. This is often multiplied by people’s common misunderstanding of what educational research can involve. Many students are surprised to discover that researching teaching and learning practice is a normal part of educational research.

One of the common reflections from students in starting research methods courses is how this is so different. Perhaps Locke, Silverman and Spirduso (2010) capture some of this in their statement:

“Some of you will have growing confidence, and others will experience performance anxiety ("can I really do this?")

What has been very positive in teaching research methodology is the overwhelmingly positive feedback we received from students as they progress through the course. They actually enjoy the experience, but much more import is that they feel it is very relevant and from doing it they feel confident, often very keen, to move on and do their research. We believe this is the result of our informal approach and basing the learning around practical projects, albeit of a very small scale.

**Practical**
When it all comes down to it undertaking research is an activity and one research methods students are preparing to undertake. Thus as they will need to do much of the research
getting a little “up close and personal” but in a safe environment would seemed like a good approach to learning and one we employed from the beginning. Our experience is not that they just learn because they read it, predominantly they learn because either they see that it works, or perhaps even more effectively, they see that something does not work. Our teaching approach emphasises that this is a “sandpit environment” where you learn and practice. And the assessment has a strong element of learning in it. The objective is to see if people are getting towards the next step of starting their actual research project with a supervisor.

The assessment was hands-on and allowed us to research in our own area. The process of actually doing, rather than just learning about a research project was an excellent teaching tool. Learnt a lot.

The objective of the “experiential” style teaching is to help students gain an appreciation of what the research process is and what it will actually mean to do research. This moves from the first learning, in undertaking a review of literature, that all published papers are not the same, there are disputes and challenges and now they, as researchers, can critique – as they too will be critiqued.

Another element of the learning approach is that the instructors, while still acknowledging that they are learning, are further along the path than the students. Thus there is richness in the interactions with students, with the organisation of the learning capturing benefits from the collaboration between students. This is not a competitive environment and it becomes clear that they all have learnings that can be shared.

Another aspect of learning skills to do research, and particularly doing this in a relatively safe environment, is that it’s OK to try different approaches in the exercises. Thus rather than doing the basic many students get very motivated and try something they find exciting. Thus we receive lots of emails as they plan and progress through a different approach.

I’ve put a lot of effort into this assignment, and have also tried a new kind of approach and way. This is a reflection of a very positive student for whom this was a very different type of course – but one who was very prepared to really look at options in approaches and take great interest in how her project was going.

**Finding your niche**

Another benefit of offering a broad “toolkit” is it raises the awareness that indeed there is a toolkit with a range of tools both quantitative and qualitative. A logical consideration then is to see that different questions can best be answered by different tools – with this experienced in defining the question and tool used. And just as there are critical alignments between research questions and the research methods through which they can be addressed, there also are alignments between researchers and methods – thus some people prefer some types of research – the methods and also the questions that means they will address.

One very satisfying response from a Masters student who was completing the course but not necessarily going on to undertake their own research:

I find the whole concept of narrative research fascinating. Initially this was a student who was completing a compulsory course, but we often see a sudden awareness that this is fun – scary and exciting! This comment came with the
comment that he could now look to the future and see starting a PhD as something exciting. Thus without the awareness of what you might do it’s hard for students to really get excited about entering the domain of undertaking a major postgrad study.

**Becoming an educational researcher**

The field of educational research has changed significantly over recent decades with the shift in methods used quite marked. Thus preparing future researchers to have knowledge only of one approach will restrict their future options. This doesn’t mean that they should be looking at the expectation that they undertake any form of research approach but at the least they should be able to access the literature produced through the field of educational research and also potentially able to collaborate with other researchers – even if not undertake a method themselves.

Thus such a course can at least be considered as the filling of the toolkit with both communication tools (how to report either proposed or completed research, including discussing literature) and also an appreciation of the methods available and the type of questions they seek to answer.

I found this course very useful for doing qualitative and quantitative research. I could apply this to my real world experience as a language teacher.

**Conclusion**

In developing an approach to teaching research methods the initial intention was to do just that – to introduce students to a range of approaches through which they could do their research. The outcome of these approaches, also seen in the broader applications of some of our research students, is that in accepting to enter some of the less known and less obvious areas of research students are also learning more to think, to feel comfortable in doing research in feeling that in working in this area where facing the unknown largely independently is the regular, students are gaining those more subtle skills of the researcher. So the question we have explored is not just “how to get across a few research tools” but by taking students on a journey with a small backpack that we gradually fill, we have filled their future research backpack with more than a few research recipes we also have added a bit of capacity for innovation, exploration and depth and rigor. And also let them see there can be a lot of fun not only in reaching the end of the tunnel but in the journey as well.

This paper reports on the application of mixed methods approaches to such preparation using exposure to research through student development of small research projects in alignment with coursework on the methods. Feedback from students indicated both a strong appreciation for the approach and also recognition of valuable learning and some change in expectations on the accessibility and usefulness of methods.

**References**


