Chapter Six

Reflecting on my Teaching and Learning in Higher Education

Introduction

In the initial part of the chapter, I will document my own learning as I teach the modules:
Computer Applications in Education (1999), (2000), and *Network Information Management* (1999), and (2000). I used them as a lead in to my main research enquiries. They provide me with an opportunity to show issues as they emerge in my practice and how I grappled with them. For the purpose of this research I will focus on two particular modules as part of my action research enquiry: *Computer Applications in Education* (2001) and *Network Information Management* (2001). The evidence of my teaching and learning on these modules includes selections from email correspondence with my supervisor, Jack Whitehead, my journal/diary entries, online dialogues with participants, and my engagement with relevant literature. Throughout this process, I engaged with participants as I attempted to help move their learning forward. I hope to make apparent this innovative interaction and its relationship with my own learning that represented an intrinsic part of the process.

Table 6.1 serves to illustrate the programme modules that form the context of my teaching and learning in the School of Computer Applications (DCU).

Teaching Context

Date	Department		Programme Title
1999-2001	Computer Applications		M.Sc. Computer Application for Education

Modules Taught

Computer Applications for Education 1999, 2000, 2001
Interactive Multimedia and Design 1999, 2000
Network Information Management 1999, 2000, 2001

Duration of Modules: 12 weeks

Programme Participants: Teachers from primary, post-primary, further and higher education.

Table 6.1

In this chapter, I deal with my teaching and learning in the context of the above modules (Table 6.1). My focus is on the *Computer Applications in Education* module (2001) and the *Network Information Management* module (2001). I discuss how I restructured these modules in the light of discussion with participants on the programme. I show how I endeavour to bring about improvement from the ground of my practice by questioning the value of the educational experience that I engage participants in. The changes brought about resulted from dialogue with participants on the programme, from my own reflections and from dialogue with my supervisor. However, changes to practice involved not only interactions between participants but involved wider structural aspects. I will show how I brought about structural change by engaging with these various factors.

In my self-study I use the action research plan as formulated by Whitehead (1989), as a framework to critically examine my practice. The action planner enabled me to critically examine my assumptions and values (Appendix A).

Background to the M.Sc. in Computer Applications for Education

In 1995, the Computer Applications department set up a Masters Degree in Computer Applications for Education. The programme had been established with the aim of providing professional educators with the knowledge and skills required for the effective use of technology in their teaching and learning context. These participants came from various backgrounds: primary, post-primary, further, higher, and adult education.

To fulfil the requirements of this MSc programme participants complete 9 modules and a dissertation. The programme was set up with the understanding that participants at primary and secondary level already had a good grounding in the pedagogic, social and philosophical issues related to educational developments and that they needed practical skills in order to incorporate the use of new technologies into teaching, delivery mechanisms and assessment methodologies. The programme was also aimed at third level educators who had graduated in non-computing disciplines and who wished to incorporate new technology in their teaching practices, but lacked the necessary understanding and skills to do so.

Computer Applications in Education Module: February – May 1999

This module was placed in the first year of the programme. At the start of the module, I wanted to create the space for participants to engage in discussion and debate around

current issues in ICT and their particular areas of interest within ICT in education. The core textbook that I used for the module was Somekh and Davis' (1997) book 'Using IT effectively in Teaching and Learning: Studies in Pre-Service and In-Service education'. I was happy to see that Somekh and Davis promoted the idea of action research as a form of inquiry for participants wishing to make use of ICT to improve student learning. Somekh argues that teachers should begin to acquire the habit of questioning the value of the educational experiences that they offer their learners. This notion of critically engaging learners with their practice was one that resonated with me. I realized that while I wanted to involve participants in the design of the modules, I had in fact developed the outline for this module in advance without involving the participants. The module was mainly lecture and discussion based, with opportunities for participants to use ready made educational software.

The general feedback from the group showed that they found the module content relevant to their teaching but that they wished to get to grips with various authoring tools so that they could develop their own multimedia and online resources specific to their needs. I realised, like proponents of action research, such as Somekh and Davis that I needed to question the educational experience that I was offering participants on the Masters programme.

Network Information Management module: October – December 1999
This module was a follow on from the *Computer Applications in Education* module and took place in the second year of the programme. As a result of my learning on the *Computer Applications in Education* module, I decided to provide participants with the opportunity to design and develop their own multimedia materials that would be

relevant in the context of their own teaching practice. This time I was determined to provide participants with the opportunity to design their own multimedia resources.

The *Computer Applications in Education* module had always been 100 percent project based. However, both the *Interactive Multimedia and Design* and the *Network Information Management* modules were mainly exam based. I doubted the appropriateness of a terminal examination if my aim was to support participants in their ongoing professional development and to help them explore how to design, develop and integrate ICT into their teaching/learning. I believed that it was important to engage participants in a critical dialogue with respect to the module goals and how they related to their individual work practices. It was becoming clear to me that my belief that participants should be creators of knowledge was linked to my emerging value that participants would need to take responsibility for their own learning by designing and developing multimedia and web based artefacts appropriate to their classroom context. I realised that if they were to become critical practitioners that they should be provided with the opportunities to explore and reflect on their own practice and show how they could improve student learning. As teacher-educator I felt sure that if participants learned to assume the role of creator of their own learning, they would become more motivated and learn to take responsibility for it. Barnett echoes similar views with regard to providing space for students: "They have to be granted and to feel that they have been granted space to make their own offerings, to formulate hesitantly their own insights, to contribute their own suggestions, to create their own products, to develop their own concepts and to engage in their own actions" (Barnett, 2000, p. 161).

Feedback received at the end of the module shows that participants found the 'hands-on' experience allowed them to integrate technology into their practice.

Although participants had the opportunity to develop web based artefacts, I felt that the values I attached to engaging participants in research into their own teaching, and demonstrating the improvement in student learning resulting from the design of the artefact, was not being adequately expressed. I realised now that participants would need to develop ICT skills within a critical reflective framework if they were to improve in a substantial and transformatory fashion their teaching through use of ICT.

Programme Board meeting (2000)

In order to make changes to a programme, the School of Computer Applications policy required the proposer to present a reasoned case for the changes at a Programme Board meeting. The *Computer Applications in Education* module was 100 percent project based. I indicated, before the meeting, that I wished to change both the *Interactive Multimedia and Design*, and *Network Information Management* modules to 100 percent coursework. In January 2000, I presented the new syllabus and assessment for these two modules at the Programme Board meeting. Staff in Computer Applications who taught on the programme and a student representative from Year 2 - the group I had taught - attended the meeting. The following two questions were raised with regard to the proposed changes from exam based to project based work:

1. Had I considered that students might be able to plagiarise if they are doing project based work?

2. Was the *Network Information Management* module now becoming too web based?

In answer to the first question, I assured the Board that the projects were grounded in the teacher's own educational practice and therefore that plagiarism would not be an issue. In answer to the second question, I pointed out that in the feedback on *Network Information Management* module participants had stressed that they would welcome more opportunities to explore the design and use of online learning environments. The student representative who was attending the meeting and who had completed the *Network Information Management* module that term, reported that feedback from participants was very positive about *Network Information Management* and that they had recommended that the module include the development and use of online learning environments. It was thus agreed by the Programme Board that both the *Interactive Multimedia and Design* and *Network Information Management* modules should be project based. It was also agreed that the *Network Information Management* module should be further developed with a focus on online learning.

Reflections on the changes in assessment

It was my hope that changing the assessment process from terminal exam to more project based work would offer participants greater opportunities to relate to the context of their own teaching and would help them to develop their capacity to integrate technology into their practice. This would also enable them to question what value technology was adding to their practice.

I wrote the following in an email to Jack Whitehead with regard to my own research question in the context of my PhD research.

Email One: (MF)   27th March, 2000

I am wondering where to start? I could look generally at changes in teaching and learning in higher education and how this may relate to the need to give students the opportunity to become more independent learners. Then, I could show how I could make use of new technologies and new methods of problem solving etc. in my own course. I could look at how I embed ICT into the programme in order to support the students and at same time be aware of underlying pedagogy supported by ICT in teaching and learning. I would have to examine the different learning technologies available and perhaps decide which is best to use in different circumstance. Throughout I will use action research to evaluate what I am doing and how the technology is being used to enable participants become more critical and independent in the module. It may mean that I have some of the session on-line rather than face-to-face.

In the excerpt above, I reflect on how I could integrate ICT into my own practice in order to better support participants on the Master's programme. It emerges from this that I had begun to see the need to use a more systematic approach in order to evaluate my own practice.

In my journal entry, I wrote the following:

Journal One: (MF)   27th March 2000

There seems to be a drive within the universities to develop teaching and learning. Dublin City University has appointed a new Dean of Teaching and Learning. A call has gone around university staff for proposals in the area of teaching and learning. I have just been reading an article by Littlejohn and Stefani. I was interested in what they had to say about the use of technology by teachers in higher education. They suggest that there is a limited conception amongst higher education teaching staff of how to use the World Wide Web effectively for teaching and learning. The say that with the increased emphasis on ICT that this may provide a platform for the development of a pedagogy for the new millennium. As I am now a lecturer in the university, I believe that I can make a contribution in this area of research.

Here, I am situating my learning in the context of DCU, where there is a growing awareness of the need to support teaching and learning in higher education. My reading of the literature suggests that ICT has a role to play in improving teaching and learning in higher education.

Purchasing of authoring software

I set about restructuring the modules and assessments and brought these changes through at Programme Board level. I believed that this restructuring would involve me in living more faithfully my own educational values. I realised that to enable me to support the professional development of teachers in a way that was meaningful to their work context, I would have to research and purchase more up-to-date, user-friendly authoring software. At the time Netscape Composer and Frontpage were the only web authoring tools available in the Computer Applications department. Having evaluated various authoring tools, I decided to purchase Macromedia Flash, Macromedia Director, Macromedia Dreamweaver and Hyperstudio.

Below, I provide a brief overview of the authoring tools I decided to use:

Macromedia Dreamweaver is a more sophisticated web-authoring package than Netscape Composer or Frontpage. It is a professional HTML editor for visually designing and managing web sites. *Macromedia Flash* is a program for creating animation for the Web. It is usually used by web designers to create beautiful, resizable, and extremely compact navigation interfaces, technical illustrations, animations, and other dazzling effects for their sites. Flash can however also be used to produce animation for teaching and learning purposes. *Macromedia Director* is a

very sophisticated authoring tool that allows one to bundle many different types of media into a single, powerful multimedia presentation. *Hyperstudio* is an interactive open-ended authoring tool to create projects and presentations. It is very popular in the USA in schools, both primary and secondary, and is used by teachers and students, including the very young. Compared with other multimedia authoring tools, for example Macromedia Director, Hyperstudio is very limited. On the other hand, it has a more favourable learning curve and it is ideal for novice developers. I felt that it would ease participants into the creation of multimedia artefacts.

Action Research Enquiry One: Co-creating a curriculum

In enquiry one, I used an action research planner (Appendix A) to present my claims to know my educational development as I ask the question, 'How do I improve the process of education here?' I outline my own educational concern as I reflected on my teaching on the module. This planner was based on the five elements outlined by Whitehead (1989):

- I experience a concern when some of my educational values are negated in my practice;
- I imagine a way of overcoming my problem;
- I act in the direction of the imagined solution;
- I evaluate the outcome of my actions;
- I modify my problems, ideas and actions, in the light of the evaluation…and the cycle begins again.

I experience a concern when some of my educational values are denied in my practice

Reflecting on my teaching on the *Computer Applications in Education* module and the *Network Information Management* module that took place in 2000, I began to see contradictions in my practice. I realised that I should have provided participants with the opportunity to reflect on their learning from one module to the next i.e. to build on their previous learning. I became conscious of the need to engage them in critical reflection on their previous learning so that they could take more control of their future learning. I invited guest lecturers from industry and education who were able to share their experiences in the use of multimedia with participants. This helped participants to place their research in a wider context.

I have already mentioned my efforts to change programme modules and assessment processes to reflect participant needs and to develop participants' capacity to make decisions about the content and process of their learning. I have begun to integrate online learning technology into my own teaching and learning. However, I am aware that I need to develop this yet further and am alive to the great growth potential of this form of technology. I can see that I need to provide participants with opportunities to reflect on the nature of their own learning and also to consider the type of data they would need to gather in order to make a judgement on the effectiveness of ICT on student learning.

I wrote the following in my learning journal during the *Computer Applications in Education* module.

> ### Journal Two: (MF)   30th March, 2000
>
> I am reading a book called 'The Internet – a Philosophical Inquiry' by Gordon Graham. In the introduction, he says that the internet is too new to allow much in the way of retrospective reflection on its nature and impact. Furthermore he quotes Neil Postman who invites us to ask of any piece of new technology – "*What is the problem to which this is the solution?*" This is a good basis for my own research. It allows me to question why I am using ICT in my own teaching and why I am encouraging teacher/participants to use ICT in their teaching.

I could see that by focusing on a question like Postman's, one would avoid introducing ICT into teaching without considering the rationale behind its use and how it might supplement, or substitute for, other forms of learning process.

I subscribed on a continuing basis to various online discussion forums on the use of ICT in teaching and learning. I was able to bring many of these discussions, topics and issues into my own teaching on the Master's programme. A particular discussion posting on the IEEE (Eye-triple-E) online discussion forum opined that academics in general, were not aware of the implications of the future of web-based delivery, and had little appreciation of the implications of the inclusion of sound and image. They posited the possibility that students might be asked to learn how to achieve their academic assignments by including sight and sound, in addition to the customary presumption of print. Allegedly, academics are failing to appreciate the long-term implications of what learning might be expected to look like in the very near future. This is an interesting point and made me question how I was living these changes in my own practice.

I imagine a solution to that concern

Before the start of the *Computer Applications in Education* module, I wrote the

following in my journal.

> **Journal Three: (MF)   18th January, 2001**
>
> If reflection can help transform practice then what framework could guide me in helping participants to reflect on their practice? I am aware of the three elements of reflection as put forward by Boud:
>
> - *returning to experience*
> - *attending to feelings*
> - *re-evaluation of the experience*

Boud (1985) ideas remind me that knowing our practice is centrally about learning to

reflect upon it. His reflective process involves looking back and looking forward.

Thus it is pointed towards future action and not just our past actions. I believed that

this would be a useful way to help participants to reflect back on their learning during

the *Interactive Multimedia and Design* module 2000. In the module, *Interactive*

Multimedia and Design, the participants had used Hyperstudio to develop a

multimedia artefact for use in their particular teaching context. At the start of the

Computer Applications in Education module, I wanted them to reflect on their

rationale for designing the artefact. I believed that if I could encourage them to reflect

on their own learning and development then they could bring their learning

experience forward to the Computer Application in Education module.

I wrote the following journal entry at the start of the *Computer Applications in*

Education module, I wrote the following:

Journal Four: (MF) 13th February 2001

I refer to Lester's article 'Assessing the self-managing learner'. He describes the move from 'fitness for purpose' to 'fitness of purpose'. 'Fitness for purpose' concerns doing something that is worthwhile. It only includes a single loop test of validity, which may be limited by purpose and depends on how the purpose has been framed e.g. the purpose may be narrow and one can pursue aims regardless of their wider consequences. In moving to 'fitness of purpose', Lester suggests that the learners be asked to reconsider their goals in relation to a wider context. Learners must question the purpose itself and the theories and action associated with it. In this case, the learners are asked to place goals within a broader context and question their own assumptions. Lester reminds us that we still have to work with assessment itself. He discusses the idea of vertical assessment and horizontal assessment. The vertical model is content based and what has been learned is compared with a model for what is expected will have been learned. A horizontal model would look at how the learner carried out the following: enquiring, creating, reflecting and evaluating.

The idea of 'fitness of purpose' was closer to what I was attempting to do on the Master's programme. By asking the analogous question, "what are we seeking to achieve by using ICT?" the programme began to move into new realms of research and knowledge acquisition. The participants were now designing and developing their own multimedia and web based artefacts rather than only using ready made software.

I developed a new project brief for this *Computer Applications in Education* module. The project involved participants in designing and developing a multimedia artefact for use in their own context. In the design and development of the artefact, they had to consider the data they needed to collect in order to make a judgement in terms of student learning. The brief also required them to relate to a particular learning theory or learning theories that they were influenced by in the design of the artefact. Through this form of project work, I believe that I would be engaging participants in a more horizontal form of assessment. They would be enquiring into their own practice, creating multimedia and web based artefacts that related to their context,

reflecting on the type of learning theory or theories and the evaluation of their use in practice. This was much closer to Lester's idea of 'fitness of purpose'. I could now envisage my reaching a situation where the module content and assessment were not developed by me alone but through a more interactive, negotiated process in which participants would also be involved in co-constructing the curriculum.

I act in the direction of the solution

During the first session, I explained that feedback received from the participants who did the *Computer Applications in Education* module, the previous year, pointed to the need to link the *Interactive Multimedia and Design* module to the *Computer Applications in Education* module so that those concerned were building on their experience. In the *Interactive Multimedia and Design* module, they had used Hyperstudio. In the *Computer Applications in Education* module, participants were introduced to more sophisticated authoring tools. They were enabled to choose an authoring tool that suited their particular area of interest.

I also wanted to try to see if we could develop a link from the practical activity of building a multimedia artefact through relating to learning theories. In the '*Introduction*' **(Video 1: DVD 2).** I can be seen dialoguing with participant as I engaged them in the design of the module.

I believed that I should develop among the participants an awareness of how important it was that each one of us should articulate our several educational values. My clarification of these values with the group can be viewed on the '*Values*' video clip' **(Video 2: DVD 2)**.

In an email to Jack Whitehead, I reported on my sharing with them the values that I wanted to live in my educational practice as teacher-educator on the programmed.

Email Two (MF)

- Promote deep learning - promote activities that will promote this form of learning
- Context - not separating knowing from doing. Situated learning - enter the community of practice.
- Creation of multiple forms of representation - allow opportunities for development of online portfolio of assessment
- Reflect on practice: Give them the opportunity to reflect on own practice.

I noted the following response from Jack Whitehead:

Email Three (JW)

One difficulty in clarifying the meaning of values is that we have a tendency to make lists of values, while the meanings of embodied values need clarifying in the course of the living relationships within which the values are being expressed. I think some video evidence is invaluable to be able to point visually to the meanings of one's educative values as they are being expressed with one's students.

I talked through ideas of Boud (1985) ideas on reflection with participants.

I encouraged participants to reflect on their learning from the previous module, *Interactive Multimedia and Design*, so that they could build on their experience by asking them to relate to these questions:

- What did you learn from the projects last term?

- What was difficult?

- What were positive and beneficial aspects of the learning experience?

- How do you plan to build from the *Interactive Multimedia and Design* to the Computer Applications for Education module?

This was in line with ideas on reflection from Boud (1985).

Answers to these questions showed that the participants enjoyed having hands on experience of developing a multimedia project. They appreciated being able to decide on their own project. They however drew attention to the time involved in developing multimedia artefacts from scratch. While discovering the vast resources available online, they experienced a severe learning curve as they encountered problems such as finding the storage space required for multimedia, downloading of audio and video clips from the web. They learned from other people working in the field of multimedia. The help they secured from these quarters in showing them how multimedia could be developed gave added value to the process.

It was evident that everyone had their own area of interest that they wanted to develop. However, opening up opportunities for them to take responsibility for their own learning proved challenging as became evident in the subsequent discussion around the form of the project and the assessment criteria. Throughout, the first session I emphasized the importance of participants choosing their own project. This led to further discussions and there was an uncertainty element. The approach disturbed some members of the group who wanted a more structured form of project.

The excerpt below is from the discussion that took place around the project and the assessment criteria. This discussion took place during the first session of the *Computer Applications in Education* module in February 2001.

Dialogue Computer Applications in Education (2001)

> **Denice:** So what's the goal then? If everything is so open and if it looks as if it is going to be left up to us to make a lot of decisions what's our goal? Different people will want different things but there has to be a goal. Do we decide our own goal because as you say yourself it has to meet a certain criteria, we need to have a goal to work to maybe in our own way to get there? Are we getting told the goal or do we have to decide the goal?
>
> **Margaret:** What is the goal for Computer Applications for Education?
>
> **Denice:** Everyone has different directions in which they want to learn. I feel there has to be some mark in the grass to keep us on track.
>
> **Ciara:** I know what I want to do.
>
> **Margaret:** There is a start. Please bring in your ideas of what you want to do next week. However I pointed out to them that this was only week one of a 12 week module.
>
> **Ciara:** But if we choose animation and I use an animation package then it will be technical or do we do a second assignment?
>
> **Michael:** Are we not supposed to relate it back to education?
>
> **Olivia:** When you have the artefact built, you say how it is going to benefit?
>
> **Denice:** Think about it before you start and decide what kind of educational benefit there will be.

Chris: You obviously choose it because you see the possible educational benefits of it in the first place.

Olivia: What will be the marking plan? I mean once the project is done on time what will be the marking plan of it?

Michael: I suppose you say what you are trying to achieve.

Nicola: And is it in line with what you want to achieve.

Denice: Say what you are trying to achieve and then say whether you have achieved it or not.

Chris: I think it is important that there is flexibility there. I think that to be exposed to different areas is important. I don't want to be singled in to an area. I would like to go into an area that I am attracted to. You have to assume that there is educational motivation in it and I can incorporate that into my job in the workplace.

Ann Marie: It seems to me that your idea (pointing to Margaret) is that you introduce us to different kinds of packages and something might grab us.

Denice: Are we then assuming that we will be designing a learning package again?

Margaret: That is what I want you to tell me.

Chris: Margaret made the point earlier that at the end of the *Interactive Multimedia and Design* module last term, she had asked us to fill in an end of module questionnaire. However the questions may not have been related to he educational values. We can go into educational areas which may not be of interest to anyone else but if they are valid educational areas then why not? If we can justify this as being valid then why not explain them?

Denice: Yes but then the assessment criteria?

Nicola: Well my understanding of assessment criteria with Margaret last term was if we choose a package and want to develop multimedia or sound. We are flexible to choose our own aspect and take it from there.

After the discussion, I asked participants to write down their goals for the module and to relate their goals to the module goals. I encouraged them to set their goals in relation to their own teaching context. I believe that it is vital to creatively engage participants in making learning their own so that they develop a more personal and professional relationship with their own practice. I listened to participants needs in order to co-create the module with them. My reason for this was that I believed that it was vital to critically engage participants in making what they were learning their own and to challenge them in their work.

I evaluate the outcome of the solution

The multimedia and web based artefacts that have been developed by participants relate to their own questions and concerns. I have developed a website with help from Hyowon Lee and Tom Sodring in the Centre for Digital Video in the School of Computer Applications, DCU. The website hosts the work of participants and this research work can be shared by other participants on the programme and indeed can be accessed by the wider public. It is interesting that Denice had many of reservations at the start of the module in terms of the direction of the module. In 'Denice' (***Video 3: DVD 2***), Denice demonstrates the artefact that she developed to her peers and discussing how the artefact was being used within her own teaching in order to bring about improvement in student learning.

I modify my practice, plans and ideas in the light of my evaluations

Next term during the *Network Information Management* module 2001, I feel that we could use the discussion features in a more dialogic way to discuss areas of concern in individual practices. Prior to teaching on the Master's programme, I had already experimented with online learning technologies, such as WebCT and LotusNotes, through professional development courses. I participated in these online learning programmes in order to find out how I could integrate online learning into my own practice. In 1999 I set up an online learning course using WebCT and used it within the Masters programme. I was mainly using WebCT to upload content material but not fundamentally changing my approach to teaching using the online learning technology. I tried to initiate discussion online during the *Computer Applications in Education* module. But in the end, I used the discussion forum to post notices and announcements.

Action Research Enquiry Two: Online Learning Journals

In this section, I show how I initiated the use of online journal writing during the *Network Information Management* module 2001. I used an action research planner (Appendix B) to outline my own educational concern as I reflect on my teaching on the module. However, in this enquiry, I will focus on the use of the action research planner by one of the participants.

The purpose of online journal writing was to provide participants with the space to articulate their own learning as they developed artefacts for use in their teaching. I hoped to provide a learning environment that would encourage deeper learning, where participants would have the opportunity to reflect on their practice in a shared

collaborative space. I believed that the 'living educational theory' approach would provide a framework and enable them to question their own underlying assumptions. I believed that this would allow participants to develop a more personal relationship with their practice and develop their capacity for self-assessment. Rogers underlines the importance of self-assessment. He believes that external evaluation does not make for personal growth: "*The more one can keep a relationship free of judgement and evaluation, the more this will permit the other person to reach the point where he recognizes that the locus of evaluation, the center of responsibility, lies within himself*" (Rogers, 1961, p. 54). This relates to my educational value of helping the participants to become responsible for their own professional development by developing the capacity to make decisions about the goals, content, process and assessment of their learning, by developing a sense of their own contribution to practice-based research.

I believed that it was important to develop participants' capacity as learners and that through reflection on their own experience they would develop a better understanding of their practice. Polanyi (1962) claimed that all knowledge has a tacit dimension through which understanding is possible, but that experience alone does not lead to knowledge. He claimed that rational reflection upon, and examination of, an experience is necessary to develop one's understanding. He called this 'personal knowledge'.

Initially, I was not sure how I was going to support participants to bring about their reflection on practice, and I was not sure of my role in encouraging them to do so. I sent the following emails to Jack Whitehead.

Email Four: (MF)   **12th October 2001**

I would like participants to keep a diary as part of their project work in building web curriculum material. Hopefully they will be able to show improvement in learning through use of the artefact in their teaching. I wonder what forms of reflection are appropriate? In my research do I need to create a framework myself or use existing frameworks? An existing framework for reflection includes three key elements to reflection (Boud, 1985).

1. returning to experience;
2. attending to feeling;
3. re-evaluating the experience.

I am probably looking for something that allows them to reflect each week on whether I lived my values (embodied) in my practice but not sure if that gets to their reflections on their own learning?

In a later email, on 15th October, I wrote the following to Jack:

Email Five: (MF) **15th October 2001**

Perhaps it is not a weekly reflection on each of my lessons but exploring my influence in helping participants to create their own living theories as they work at improving the quality of student learning. It may be that they will only have time to develop material this term, and might not have time to think of how artefacts could improve student learning. However, they still will need to think about how they might be able to improve student learning through use of artefacts. Perhaps their reflections will be on their work with students and their own development posted each week to WebCT with my response to each of them. So I would be responding to their work as they try to improve the quality of learning for their students. Their reflections would be their work in progress as they attempt to develop curriculum based material for the internet in order to improve the quality of student learning - now does this make sense?

In an email response, Jack Whitehead responded by encouraging me to look over the

emails that I sent to him on 12th and 15th October 2000 to see the developments in

my own learning.

Email Six (JW)

I like what you say about the portfolios developing together with your responses. I wonder what idea of a 'curriculum' is implicit/emerging in your practice. I feel it's very close to the idea that individuals are creating their own curriculum through an engaged relation with the 'given curriculum'. I'm thinking of a curriculum in the sense of a curriculum vitae meaning the course of one's life.

On looking over the emails again, I was able to see developments in my own thinking

and understanding with regard to how I could begin to integrate online learning

journal writing into the *Network Information Management* module.

During the module, I found it challenging to introduce the 'living educational theory'

approach as well as supporting participants, as they designed and developed online

learning material. I spent time in face-to-face class sessions, answering questions

related to 'living educational theory', as this was a new approach to participants.

I wrote the following in my journal.

Journal Five: (MF) 12th October, 2001

This evening (Tuesday) the group worked through the action research process. There was a very positive response. They mentioned that they were answering questions that they never actually asked themselves before. We will start to write online learning journals and this will allow each person to document their own learning. I worked through Jean McNiff's book 'Action Research: Principles and Practices' and summarized ideas and presented to group. This resulted in lively discussions around the action research process.

I hope that through working through the action research process, that they could see

the value of documenting the process of their own learning.

Jack Whitehead has amended his earlier formulation of "I experience a concern, I

imagine a solution, I act in the direction of the imagined solution", I evaluate the

outcome of the solution, I modify my practice, plans and ideas in the light of the evaluation." From this there flows the following action plan.

- What is my concern?

- Why am I concerned?

- What do I think I can do about it?

- What will I do about it?

- How will I gather evidence to show that I am influencing the situation?

- How will I ensure that any judgements I make are reasonably fair and accurate?

- What will I do then?

I arranged a desktop videoconferencing, using iVisit, to link up with Jack Whitehead at the University of Bath. I asked each of the participants to prepare a short five-minute presentation on their research question. They had not met Jack Whitehead before but as they were using the Whitehead's 'living educational theory' approach, I thought that this would be an ideal opportunity for them to share their work with him. I also wanted participants to experience how ICT could support learning and teaching. During the videoconferencing session, each of the participants discussed his/her action research question with Jack and he responded, and focused them on their own learning. The videoconferencing technology added an extra dimension or a sense of presence, to our communication, allowing us to behave synchronously (real time) with the audio and video facilities. It also provided the participants with the opportunity to present their research questions in a shared, collaborative environment and to gain feedback, thus providing further opportunities for reflection.

I will present the online learning journals of Ann Marie Mee, a science teacher in a post-primary school in Dublin. I will show how I supported Ann Marie's efforts to articulate her own educational values as she developed an online learning course for her science class. By including the voice of Ann Marie in this presentation, I also hope to show how, through time, listening and awareness became part of my response in helping to move her learning forward.

Ann Marie Mee's online journals

In her online journal entry of November 28th, Ann Marie used the amended action research planner to help her focus on a concern in her own practice and to articulate how she intended to gather data in order to provide evidence of how she had improved student learning.

For the purpose of clarity, I provide a colour reference code to represent the various speakers in the following dialogues:

Colour Reference Codes

Margaret's response in **red**
Ann Marie's response in **dark blue**
My reflections on the learning process in **black**

Posted by Anne Marie Mee

Wed Nov 28, 2001 21:05

Margaret,

At last I've made time to think through what exactly I'm going to do for this assignment. I've forced myself to narrow down the subject area that I'm going to concern myself with. Here are my thoughts in the form of an action research planner

Action Research Planner

What am I concerned about?/Why am I concerned?

There is a new option on the Leaving Cert Physics course, called particle physics. It is new material to me too. At a recent in-service meeting the coordinator indicated that there appeared to be less than 20 percent of physics teachers planning to teach this option. The main reasons - probably the teachers' lack of familiarity with the material, also the fact that there were no practical/demonstrations suitable for the lab. Therefore it might be perceived as 'boring'. I have also been interested in encouraging my students to access the web for back-up material, etc. but feel that this would be of greater benefit if it could be directed and also monitored.

What do I think I am going to do about it?/What am I going to do about it?

I am hoping to be able to develop a module to teach the particle physics option for Leaving Cert and to put it in WebCT. Within the course material I will include links to relevant websites and maybe try to develop some Flash animations to explain some concepts.

How will I gather evidence to show that I am influencing the situation?

This is new subject matter for me and a new approach to teaching. I am trying to promote student centred learning where I am the facilitator or provide the scaffolding…. constructivism. I am also hoping that some collaborative learning will take place via the chat rooms in WebCT…… both between students and between students and me. This can be monitored in WebCT. I can monitor the number of times that each student accesses the course.

The questions that students ask me and each other, both in chat rooms and in class, will be important indicators of their understanding and their motivation. My past records and knowledge of individual students could be used to compare their motivation/participation/understanding/application.

A test at the end of a reasonable time - testing learning, understanding and application of knowledge. Discussion with the students afterwards about their opinions on the effectiveness of learning in this new way. I could also ask a colleague to assess my course from a teacher's perspective.

Act and Gather Data/ How will I ensure that any judgements I make are reasonably fair and accurate?

Now I must put the course together. To date I have spent time searching the web for suitable website links. I have also been learning the subject matter myself. My course will contain the basic elements needed for this topic, hopefully presented in a way that will motivate the students to learn better and to look for more information. I hope that one of the outcomes will be that the more motivated and more able students will have

an opportunity to delve further into the topic. This is difficult to incorporate into a traditional class where there are many abilities and interests…….. the norm is to pitch the class to the middle.

I respond to Ann Marie by asking her to think about how she is going to show that she has promoted student-centered learning and collaboration.

Posted by Margaret Farren

Thu Nov 29, 2001 14:05

Ann Marie,

It looks as if you are working through the action research cycle. You say that you want to promote student centered learning and collaboration, using online learning. The difficulty of measuring motivation was highlighted during the videoconferencing link up with Jack Whitehead last Tuesday evening.   The question now is how do you intend to promote student learning? Again the focus will be on learning.

Margaret

My reflections on Ann Marie's learning (MF)

Ann Marie was clearly focusing on the questions in the action research planner and starting from a concern in her own practice. She articulated her intention of promoting a student-centred and collaborative approach to learning. I asked Ann Marie how she was going to be able to show that she was living her values of student centred learning and collaboration in her practice. This was Ann Marie's first experience of integrating online learning into her teaching. Thus the opportunity had arisen to integrate online learning technology in a manner consistent with her own

educational values. I asked her about how she intended to demonstrate that she was promoting student-centred learning and collaboration. My object was to focus her mind on the sort of data she would need to gather in order to actually demonstrate that an improvement in student learning had been brought about. A systematic approach to collecting data would be of capital importance in ensuring that her claims regarding improved student learning were fed into a knowledge base of practice.

Posted by Anne Marie Mee

Sat Dec 01, 2001 23:37

Hi Margaret,

Since talking with Jack Whitehead on Tuesday I've been trying to get my head around this action research thing.

I definitely had the wrong emphasis. I was concentrating on trying to learn to use an online tool to deliver a course, set up chat rooms, get students to use a network facility, learn how to use the various tools in WebCT to monitor students, etc.

I should have been thinking more about my values and reasons for teaching things the way I do, what I consider to be key factors in my approach to teaching a particular class of students or particular material, etc. How could I improve some area(s)of my teaching?

What do I expect my students to learn from my teaching? How can I know that I am achieving my desired outcomes? What can I do to keep my classes interesting, relevant, up-to-date .... Am I passing on anything useful to my

students? Am I utilising the experience I have gained over the years to make the most of my teaching?   So, what are the things that I value most? Will return tomorrow

Ann Marie

My reflections on Ann Marie's learning (MF)

The videoconferencing link up with Jack Whitehead certainly encouraged Ann Marie to reflect on her role as teacher. Ann Marie had begun to see the importance of focusing on her own educational values and reasons for teaching in a particular way. Ann Marie had also begun to see the importance of the 'I' in the enquiry and how a focus on her learning can in turn help her focus on the process of student learning. She was also seeing the personal benefit she could derive from focusing on her own learning.

Posted by Anne Marie Mee

Mon Dec 03, 2001 00:42

Hi Margaret,

Some of my thoughts, hopefully not too disjointed. Am I on the right track?

I have been trying to do some more things with WebCT and am coming to the conclusion that it might be an idea to put any Flash, graphics, etc. onto a website and create links from WebCT to there. Enough for today - (below attached file).

How will I ensure my judgements are reasonably fair and accurate?

Traditional teaching methods and methodology place the teacher in the dominant role of instructor, information provider and often performer in a classroom. I find more

and more that this role is becoming difficult and inadequate. How can I compete with the vast range of far superior presentation methods available to students in the media, TV, etc.? How can I keep up with all the 'knowledge' that is available. How can I provide for the many interest and ability levels of my students? In the past this was always difficult as I, like other teachers, was limited by the facilities that I had in my classroom. Now it should be easier. There is a vast store of resources available by way of technology and in particular the world wide web. But how can I use them effectively?

My reflections on Ann Marie's learning (MF)

Ann Marie had now become more confident about articulating her own educational values. With the limited class time available - the Computer Applications for Education Masters degree was a part-time course - it was often difficult to hear about the concerns different teachers were experiencing in their teaching as each grappled with new developments in curriculum, technology and teaching methodologies. Although these issues were addressed and discussed during face-to-face sessions, the online learning environment provided a space for teachers to reflect and articulate and share with others. Some concerns were specific to the context, others however were common to all contemporary teachers faced with a variety of alternative methods of teaching.

Anne Marie further elaborates on these concerns

As a teacher of Physics to girls for 20 years, I have been 'fighting' the traditional view that physics was a 'boy's' subject and to be a girl and do physics you must be very intelligent, (and probably a bit strange!). In fact, 20 years ago it was quite unusual to

find Physics on the curriculum in a girl's school. In the early days only the most intelligent students in my school chose to do physics - this was roughly 6 percent of a particular class. My argument has always been that if you want to do physics, that if you work at it, it should not be any more difficult than any other subject. The numbers choosing to do physics have risen over the years to on average 20 percent of a class group with a bumper 33 percent of fifth years this year. Now the class is a mixture of abilities. I believe that brighter students can help weaker students and in doing so can improve their own learning. I like to encourage the students to learn from each other. In reality this is possible, using my current methodologies, only during practical classes. In these classes it is often the less bright students who are better at 'putting the apparatus together', while the better students understand the theory behind the practical.

As a teacher of Physics, without a degree in Physics, I have always been aware of the difficulties of students, mainly because I would have encountered them a few nights before myself. From the beginning I was very aware that many of the students sitting in front of me were far more intelligent than I. Therefore I have always been learning from them. This is an aspect of teaching that I really value. I feel that it 'keeps me on my toes' always, hopefully keeps me in touch with the things that students find difficult and the things that most interest the students. It also means that while the curriculum changes little from year to year teaching never becomes routine.

I put a great emphasis on learning by doing. I also think that if something is made relevant to everyday experience that it is easier to learn. As the age gap widens between my students and I, I am more conscious that the gap is widening between

what I consider and what they consider to be relevant to their everyday experiences. Therefore I would like to see myself moving more into the role of facilitator and a guide of their learning processes or as the scaffolding for learning that Vygotsky describes.

My reflections on Ann Marie's learning (MF)

Ann Marie's educational values come across with some clarity in the above text. During the *Computer Applications in Education* module, which took place the previous term, we explored various theories of learning. One of the assignments involved the teachers in researching a particular theory that related to the multimedia artefact that they had developed. However in the midst of developing skills in different technologies and exploring new theories of learning and teaching, it is often easy to ignore the tacit knowledge that a teacher possesses or acquires. Although these ideas were explored during the face-to-face sessions, the online environment did provide that space for reflection and the articulation of personal values. Perhaps even in classroom situations it would be less easy to get at this knowledge and self knowledge that the on-line experience could elicit.

Ann Marie (Continued)

The ultimate aim of most of my students is to get as high a grade as they can in Physics in the Leaving Cert. I believe that this is only possible if they have been motivated enough to develop an interest in some parts of the physics course, if they feel that each has a valuable contribution to make to the class and they feel confident in their own ability. I firmly believe that every student can learn from every other student and that as a teacher I am always learning with my students.

I need constant feedback from my students - I believe that this is the best way of assessing my effectiveness as a teacher. I welcome this feedback in the form of questions, comments, suggestions, as well as the conventional student performance in exams. Unfortunately, as class sizes get bigger communication between individuals, student and student and student and teacher, gets more difficult. Often the quieter student is more reluctant to speak up and yet his or her contribution is as valuable as anyone else's. This is something that I have become very aware of as Physics has become a more accepted choice for the girls in my school and therefore the class sizes have increased. While the informality of practical classes gives lots of scope for collaborative learning and communication between the students and students and me, it is much more difficult to put into practice in theory classes.

I find it very difficult to put these values into words, but it has made me focus on what it is that makes me the kind of teacher that I am. I would love to ask my students to answer the same question about me. I would hope that there might be some overlap!

My reflections on Ann Marie's learning (MF)

Ann Marie is seeking to discover her values through reflection on her practice in the context of the classroom situation that she encounters.

Anne Marie (Continued)

So how do I improve my practice? How can I improve my role as a facilitator of learning in my teaching of Physics to Leaving Certificate students?

I would like to focus on the area of my theory classes as I feel that this is where I could make the greatest improvements. I would like to make myself more of a facilitator for learning. There are two things that I would like to incorporate into my pedagogy: (i) I would like to encourage of the use of the world wide web by my students and (ii) I would like to promote more collaborative learning both between the students and with me. I would like to look at the use of the world wide web for two purposes: (i) as a resource to provide information/graphics/ animations for curriculum topics for which there are no practical or demonstrations possible in a usual classroom/lab situation, (ii) as a resource to provide links to information relating to the curriculum which is topical, up to date or which a student may have an interest in pursuing. This could be particularly relevant for the new Science, Technology and Society component of the Leaving Cert Physics curriculum.

It is clear that this passage represents a real shift from the following online diary entry of December 1st, "I was concentrating on trying to learn to use an online tool to deliver a course, set up chat rooms, get students to use a network facility, learn how to use the various tools in WebCT to monitor students, etc." Ann Marie is now asking questions such as 'So how do I improve my practice? 'How can I improve my role as a facilitator of learning in my teaching of Physics to Leaving Cert students?" She has discovered a particular part of the Physics curriculum, which she could focus on in order to bring about improvement in student learning. In my view, the key part of Ann Marie's learning is the link she is now making between pedagogy, technology and student learning.

Posted by Margaret Farren

Wed Dec 05, 2001 15:56

Ann Marie,

Many thanks for the background and context. I agree - it is really difficult to put into words the meaning of our own educational values. I am sure that writing it down does help us to articulate the meanings of our values.

You have identified the advantages of each student learning from one another and learning by doing as values, which you hold and try to promote in practical sessions.

The fact that 33 percent are doing Physics this year and they are of mixed ability is an achievement. How can online learning and ICT help further develop collaborative learning and learning by doing?

Your concern: 'How do I improve my role as a facilitator of learning using ICT in the teaching of Physics theory to Leaving Cert students?'

How can you show - provide evidence - of your doing this?

Margaret

My reflections on Ann Marie's learning (MF)

I could have said so much more about the importance of what Ann Marie had actually expressed and communicated to us all in her online journals. How much would have been lost from her whole educational development if she had not articulated in writing

her own values as she worked through the action research process. Although Ann Marie does relate and integrate different theories of learning into her project work, she does not simply apply these theories to practice. Through the process, she has come to a better understanding of the importance of understanding her own goals and values. Ann Marie was engaged in a transforming personal voyage of discovery. I was able to support her by enabling her to construct her own narrative of her learning in relation with others, valuing her originality of mind and critical judgements, values and desires for enquiry learning on the part of her learning. Didactic interactions by contrast, might have weakened her sense of personal ownership of her action research. Ann Marie integrated these online journal entries into her *Network Information Management* assignment.

Ann Marie (Continued)

As a teacher involved in action research, I found myself learning by doing, creating, thinking, collaborating with colleagues, and getting feedback. These are some of the key values that I hold in relation to learning and teaching. I probably place more emphasis on them for the students but realize that they are as important for me if I am to be a better, more effective teacher.

The opportunity to carry out action research gave me a chance to think about how improvement in my teaching might be brought about by integrating some tools of technology into my teaching and my learning process and those of the students.

As students become ever more familiar with the latest technologies, the gap between them and their teachers could become enormous if teachers do not think about their

practice and 'learn' about new ways of teaching. It is important that teachers do not use technology just because it is there. They must have a pedagogic reason for using it. Reflection on practice will become important as more and more 'tools' become available.

I believe that the integration of new technology tools into the teaching and learning process will require a shift of emphasis from the traditional role of the teacher as 'information provider' to the 'teacher as facilitator'.

Analysis of my influence on Ann Marie's learning

In the previous account, I have shown the processes involved as I support a teacher's efforts to articulate her own learning through use of online journal writing during the *Network Information Management* module. When I started to teach on this module in 1999, the module syllabus was focussed on the technical aspects of using the technology. In the above account, I hope that I have shown how through the revised 100 percent project based assignments, participants are still learning about technology but they are doing so in a meaningful context, and in relation to their own educational development and student learning. My purpose in 1999 in presenting my reasons at Programme Board with regard to changing this module from mainly exam based to 100 percent assignment based was to enable the above type of learning to happen. Participants are still learning the technical skills but the technical is linked to the concerns and values, which each teacher brings to their educational practice as they grapple with new ways of using the technology to improve student learning. With the upsurge in the use of online learning environments, it is vital that participants

understand how they can best make use of online learning to improve their practice and student learning.

In the extracts of dialogues, above, I responded to Ann Marie in a supportive way in order to help move her learning forward. The online dialogue shows examples of interactions between myself and Ann Marie. It is interesting that none of the participants responded to one another's journal entries during the module. It is evident from some of the journal entries, on the other hand, that they did refer to other participant's journals. We did not set any ground rules on this at the start of the module, e.g. length of journal entry, number of journal entries per week etc. I did not know if participants would document their learning online. This may have been due to my responding to their questions rather than enabling the participants to respond to each other.

On reflection, I concluded that excessive teacher/participant dialogues crowded out broader conversations and the development of a real sense of online community of practice. The online forum did not amount to a truly collaborative learning environment. Although from the online learning dialogues it was evident that each participant was deeply engaged in the process of his/her own personal learning, collaboration and peer-to-peer interaction did not seem to be happening through the online learning forum. Participants were using the latter to articulate their concerns and were sharing their learning with me while I was responding to each to help move their enquiries forward. Nevertheless, this was certainly an improvement on my previous use of the online environment that had previously been limited to course content delivery and circulation of notices to participants.

Participants' online learning journals were not formally assessed. However, I encouraged participants to articulate and note down their own values over the period of the module. I believed that this process of reflecting and articulating, through writing, would enable them to come to a better understanding of their own practice [WWW6] [DVD1]. I believed that the online learning journals could act as an aid and enable each teacher-participant to look back and see their own learning progress. However, the journals were posted to a shared online environment, and this meant that participants could read one another's reflections, respond to them and learning could take place in a social environment.

Ann Marie's evaluation of her learning

I was gratified to receive the following e – mail from Anne Marie Mee in response to my request for comment on the methodology I had been employing:

From:	*"Anne Marie Mee" <ammee@esatclear.ie>*
To:	*"Margaret Farren" <Margaret.Farren@dcu.ie>*
Subjet	*Comments*
Sent:	*Fri, 13 Aug 2004 16:45:23 +0100*

Hi Margaret,

I find it interesting that at the start you had questions and doubts about how to go about gathering data and expressed these to Jack Whitehead via emails. His encouraging responses helped you to answer your own questions and to see the way forward. It reminded me of my situation when your encouragement and communications via WebCT helped me through the Action Research process. I

remember when I had finished this assignment feeling that I really did understand what Action Research was and that I had actually carried it out. When I look back over my journal entries now I'm surprised at how I articulated my thoughts, values and doubts – very honestly – for others to read! I can also see the progression that I made through the process and how your always positive comments, encouragement and leading questions brought me there. The use of online dialogue was also a key element as it meant that there were no 'constraints' on when/where the thinking and communication happened. For example, if I had a quiet time late in the evening to think I could always post my communication then and read your response when I had time to assimilate it. The failure of the class members to communicate online was probably because it was easy to communicate 'face to face' or by phone. Or maybe there was still an element of regarding you in the 'traditional' role of the teacher.

Since finishing, I find myself frequently trying to think - how can I make a class more interesting, how can I help the weaker student in the class, how can I make learning more relevant, etc. I spend a bit of time trying to source online and other resources. I have tried to introduce a system of self assessment for some of the non-exam students. I find it frustrating that shortage of resources and the size of classes and the 'points system' can make the role of teacher as facilitator difficult to carry out in reality. I do believe that the Action Research approach to teaching should provide a better way of learning for individuals of all abilities.

Most of the taught courses for the M.Sc. were structured in the traditional format of lecturer as information provider. Your sessions were not. There was a topic/ questions/ presentation by an expert followed by questions/ videolinks/ experimenting

with different multimedia packages and hardware/ group discussions/ etc. where you were as much a part of the group as the teacher. However, you always directed the course of the session with questions, discussion pointers, etc. It was quite informal. At first I found this 'new' approach difficult to cope with. At the end it made me think a lot more about my capabilities, my values as an educator, my own teaching methodologies. I really enjoyed attending sessions for these two courses. We got a chance to sample a broad range of multimedia and web based resources and to choose those that suited our needs/interests at that time. There was always a lot of collaboration between class members and between class members and you – helping each other with new software, technical problems, suggestions for designs, assignments, etc. Having no terminal exam was a bonus and was a great incentive to put a lot of effort into assignments and feel a sense of achievement. You always negotiated with us and encouraged us – there were never negative responses. I was very slow to get going with the WebCT online dialogues. It was like thinking out loud and there was a certain fear of 'exposing' oneself associated with that. Teachers tend to work and think alone.

I believe that most of the values that you have listed in the document are illustrated by these kind of disjointed memories. Your dedication and commitment to the process of education and your interest in your students is memorable and fairly unique in my experience.

Ann Marie

Conclusion

The purpose of the online learning journals was to provide participants with opportunities to document their learning as they developed web based artefacts for use in their work contexts. The goal of the enquiry was to develop participants' capacity to take control of and responsibility for their own learning. The enquiry focused on how one participant, Ann Marie Mee, engaged in this process. The main record of how I encouraged her to engage in this process can be found in her online learning journals [WWW6]. I was pleased to note the degree of success I had achieved in evoking through online dialogue, a personally proactive approach by participants not only to knowledge acquisition but to the application of action research in their own teaching practice. At the same time I became conscious of a missed opportunity to enlarge my own dialogue and to supplement this with inter participant dialogue. Each participant had engaged in dialogue with me rather than with one another. I began to see the potential for using the online learning environment to support participants in dialogue with one another as they articulated their own concerns in practice. In light of my learning, I reconsidered my use of the online learning environment in order to foster more intensive student/student interchange. This will be dealt with in chapter eight. I will now continue to focus on supporting participants and my role as supervisor of masters degree research.