

INQUIRY METHOD AND REFLECTIVE PRACTICE IN TEACHING ENGINEERING FIELD

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Abstract

This paper reflects a research done on a cohort of engineering lecturers (20 new lecturers in mechanical engineering) with the aims of emergent the effectiveness of inquiry method and reflective practice in engineering field. Part one pealed the participatory action research design methodology and the reflective model used. It explored the notion of reflective practice and participatory action research and it impact to the innovative and creative teaching and strategies in respective engineering faculty. Part two discussed how the data was gathered. Part three illustrates how content analysis procedure used for data analysis to improve teaching knowledge base. Research finding, is in part four, it explained the introductory and advanced coaching during the cycle of participatory action research. The challenges faced by the practitioner of participatory action research were discussed on depth. All reflective journals of the 20 lecturers were analyzed and eight teaching knowledge bases were identified through content analysis. The fifth part, explained the most important teaching knowledge base

1.0 INTRODUCTION

This article show how the idea of reflective practice and participatory action research was explicitly brought by professor and their cohort engineering lecturer in Universiti Teknikal Malaysia Melaka (UTeM) that was volunteer to

reflected by lecturers was self-knowledge as lecturer, knowledge of learners and knowledge of context of industries. The role of peers, university supervisors in creating collaborative emergent the effectiveness of educational practice is discussed widely. Part six concluded that this study affirmed that participatory action research and reflective practice could be applied in engineering faculty as an appropriate means to enhance professional development among engineering lecturers.

Keyword

Inquiry Method
Reflective Practice
Teaching Knowledge Base
Grounded Theory
Constructivist
Participatory Action Research

create and improve from the conventional system of teaching and learning to initiated curriculum reforms based on their engineering subject matter. According to Foshay (1998:110) and (Hanipah (2004:37) during the process of reflective practice and participatory action research,

the professor and new lecturers learn together to establish a systematic, orderly procedure for exploring problems and finding possible actions to eliminate problems or at least to make them more manageable in nature of student and the university. Dewey (1933), Bruner (1960) and Richard Suchman (1962) developed an approach called inquiry training. In higher level of learning processes lecturer present student with puzzling situation or discrepant events which spark curiosity and motivate inductive approach where student give many questions before they get the right answer. Inquiry method include statements which describe abstract intellectual processes and operations.

1.1 Statement of the Problem

When cohort of new lecturers from (Kolej Kemahiran Tinggi MARA, (KKTM) come over to Universiti Teknikal Malaysia Melaka early January 2007, we have big task to do. It is about to train new mechanical engineering lecturers for new mechanical engineering college in Malaysia. As we are concern Engineering subject matter and many aspects of inquiry are viewed by objectivist as means to discover this objective reality. Lecturers, from the objectivist perspective are individuals who are acquired a sufficient engineering knowledge based. Their role is to transmit their knowledge (fact,

concepts and principles) to engineering students.

The content and the nature of engineering lecturer's thinking toward pedagogical content knowledge are some what personal and meaning is constructed by the learner through experience and it is known as constructivism. Learning to teach for new engineering lecturers just a social process in which learners construct meaning, which is influenced by the interaction of prior knowledge and new learning events.

One more importance in training new lecturers in engineering field is teaching from a constructivist perspective. Mean, train them not viewed as telling or transmitting fixed truths to students but rather as providing students with relevant experiences and subsequent opportunities for dialogue so meaning can evolve and can be constructed. In this way of pedagogical training, the engineering's curriculum from this perspective is no longer viewed as a document of important information, but instead as a set of learning events and activities through which new lecturers and the pedagogy trainer jointly negotiate content and meaning. For that reason this study take place in participatory action research form and used reflective journal to encourage new lecturers in engineering field to practice a constructivist during their

training to be lecturer. And we will come to see that a constructivist perspective will require drastic changes in lecturer's behaviour.

This study also takes in account the predictions and changes in future education that emphasizes the need of lecturers that are knowledgeable in general pedagogy and content pedagogy, innovative and use the practice and application oriented education at UTeM. This awareness has brought all professor and lecturers from every faculty to continue the effort of the organization to implement the education approach. Reflective practices and participatory action research in teaching process is one of the tool that has been chosen as an engine to move the educational approach in to practice in every faculty through participatory action research design. Lecturers have to learn new skills during teaching that we know as reflective writing. To persuade that 'learning to be reflective' has been in line with application orientation during teaching my cohort and I develop a serial design of participatory action research. The serial design included two cycles in order to answer the process of practicing the reflective writing and to take an action to new teaching and learning techniques collaboratively between me as a

pedagogies expert and my student as a new lecturer in their engineering field.

1.2 Why reflective practice and participatory action research is needed in constructivist way of teaching?

- i. To increase lecturers competence in pedagogical reasoning.
- ii. To increase the awareness of giving a meaning to classroom experience.
- iii. To produce lecturers those are able to think and take action without being asked to do so in increasing their professionalism.
- iv. To produce lecturers those are innovative and proactive in order to increase the skill of assessing their strength and weakness as a lecturer.

1.3 The objective of the research / what prompted it to be constructivist?

- i. To explore the experience of the implementation of reflective practice through participatory action research in teaching engineering subject matter.
- ii. To analyze the teaching and learning problems of lecturers through their writings in the reflective journals.
- iii. To identify the trust and values of lecturers towards their colleagues, supervisor and professor that influences their pedagogical way of thinking.

The study focuses on the content of reflective writing in helping lecturers to

develop their pedagogical reasoning in classroom during field experiences. At last this study brings forward these research questions clearly:

1.4 Research Questions

1. Does teaching philosophy and pedagogical reasoning constructed toward respective engineering field by reflective writing?
2. Does the reflective format facilitate lecturers to think reflectively in engineering curriculum practice?
3. What do lecturers report about the influence of the university community (colleagues, mentors and professor) in developing pedagogical reasoning

2.0 LITERATURE REVIEW

Background of the Action Research

1990's in Malaysia, EPRD cooperation of the schools, Kim Paik Lah (1994), Syarifah Bee Abu Bakar (1998) Hanipah Hussin (1999) used Action Research to increase the professionalism level of student teachers in Teacher's Training Division. 1980's in Australia, Europe and America, Action Research is used as an empirical and systematic tool to increase the schools performance. 1991, in Europe, John Elliot use this method in Ford Teaching Project as an approach to help lecturers combine inquisitive effort in teaching and learning in the classroom. Kurt Lewin a social psychologist

emphasize collaborative effort to further improve work performance in his department (Kemmis and Mc Taggart), (1981). In 1953, Lewin's idea is used in Lecturers College, Colombia University, New York as a research approach in schools.

The central points are *Teaching Knowledge Base* (Shulman:1987). In this matter, the researcher uses reflective as the effective tool to create the awareness in beginner lecturers of a lecturer's role and their accountability toward organization and Allah/God. This is clearly the main root towards building lecturers professionalism in Malaysian ways of philosophic.

3.0 METHOD AND PROCEDURE IN ACTION RESEARCH

The research design that is used by the researcher is Participatory Action Research Design as in Table 1

Type of Action Research	Aim
Participatory Action Research in classroom	Formatted the reflective writing to help lecturer reflect effectively. The effectiveness of reflective practice in developing professionalism
Head Researcher/Professor Roles	The Relationship between facilitator and subjects
Co-researcher / Principles Researcher coaching and scaffolds and encouraging self reflection	Co-operation (Consultation) Coach Scaffold
The Relationship between facilitator and subjects	Co-operation (Consultation) Coach Scaffold

Source: Zuber-Skerrit,Ortrun (1996:4, Hanipah Hussin 2004:50)

Although the study included some faculty but then, this research has a few limitations in these areas:

It was a 20-acceptance reflective journal, which was, involves one Asst. Professor (researcher) and 20 lecturers that share the

3.1 Cohort

20 new lecturers in mechanical engineering from Kolej Kemahiran Tinggi MARA. An interesting point that the researcher wants to highlight is the researcher has choose content pedagogy and general pedagogy based on cohort study and all were directly under the researcher's supervision. The good point about this is coaching and scaffolding can be done directly to the participant during field experience in all spirals planed by the researcher. Below is one of acknowledgment given by Australian professor when the participatory action research strategies used in one of my previous work back in 1998:

3.2 Method and Participatory Action Research Procedures

Qualitative approach used in this research. Participatory Action Research Model and Reflective Model have been used as a technique to gather data. Figure 2 below show that Action research model that is used has two cycles (reflect 2 phases)

clinical supervision during micro-teaching session

Based on the small number of participant the research findings can only show the processes of reflective practice are successfully done in engineering subject matter with interesting content and natu

'Although Hanipah rightly pointed out that her finding of her study are not intended to be broad-spectrum, after reading her thesis, I suspect that there may be many commonalties in the difficulties experienced by lecturer and professor in the Malaysian context, and those experienced by many Australian lecturer and professor. These commonalties suggest that they may be considerable potential for cross-cultural differences between the two contexts. I found the study valuable in that it alerted me to this possibility. An additional strength of the study, in my view, is that it very clearly demonstrates the usefulness of participatory action research in addressing the ongoing challenges in developing professional lecturers in university.

(Dr.Jennifer Sumsion, Professor in Faculty of Education, Macquarie University, Australia-November,1998)

where every cycle has fives smaller spiral (reflect 5 element in teaching: plan, implement, evaluate, reflect and re-plan to improve teaching knowledge base). The reflective practice that is used moves two cycles and smaller spiral simultaneously. This technique is called second order action research where the researcher as a

pedagogy professor and new lecturer subject matter involve in coaching and scaffolding, to construct teaching knowledge base together, exchange information, reflective and re-plan

teaching and learning to improve the current practice in engineering field.

Figure 1: Reflective Practice on Participatory Action Research

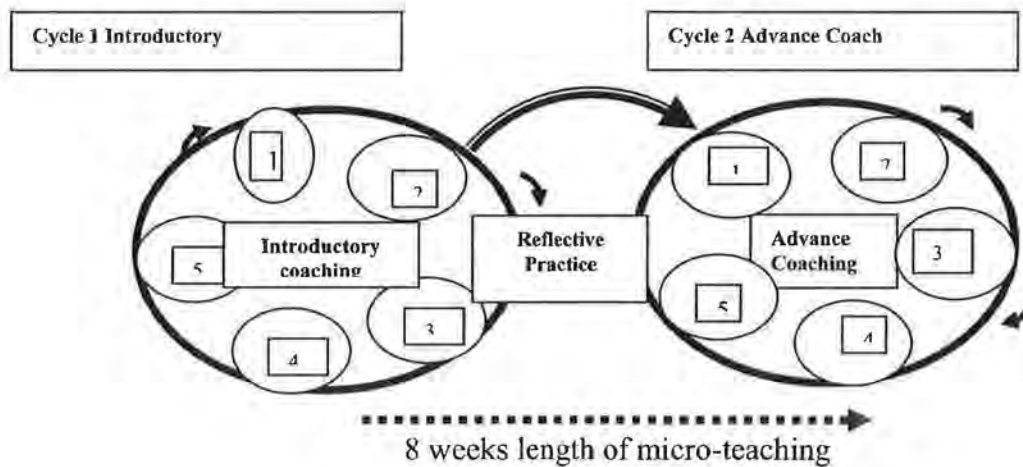


Figure 1: Reflective Practice

3.3 Triangulation technique

Triangulation technique has been used to make sure the data is valid. The triangulation process is repeated until the 5th spiral in the participatory action research model.

There are ways that has been used by the researcher to gather data that is.

1. New Lecturer's weekly reflective journal.
2. Transcript from video tape of feedback session
3. Researcher's weekly reflective journal
4. Feedback forms of clinical supervision from supervisor/professor

3.4 Data Analysis

Data analysis in this study followed the Strauss and Corbin (1990) procedures called Reflection on Data Analysis in Participatory Action Research. Researcher used the participants data entry or data collection (for example interview, journal, observational forms) and followed

4.0 FINDINGS OF THE RESEARCH

The findings of this research, the thinking pattern of the trainees can be detected by the content of reflective writing journal during reflective practice after micro-

teaching session. The result of construction knowledge teaching base can be shown as below:

TABLE 2: KNOWLEDGE TEACHING BASE

Category	Property
1. Self knowledge as a lecturer	260
2. Knowledge of students	130

5.0 THE IMPLICATION OF THE STUDY

5.1 Researcher Reflects on Their Experienced

'I learned, as a pedagogies professor, theories can be explicitly practices, and that theorizing consisted of articulating those 'tacit theories' and subjecting them

5.2 Participant Feedback

'...Second session is practical knowledge in machine for three months. In the session of pedagogy, I learnt the methods and techniques how to teach the students effectively. I also learnt to create a teaching portfolio given by Associate Professor Dr. Hanipah Hussin. From this portfolio I learn how to develop lesson plan, I create my learning output and I can differentiate the behavioural and non behavioural aspect among learners, I can plan my lesson individually. My reflective writing getting better and I have my own philosophical terminology that I believe could be drive me to be a great lecturer in engineering field.

For pedagogy and teaching skill, I want to use Problem Base Learning (PBL) and Project Oriented Problem Base Learning (POPBL) in my classes. For my subject KMEM 4344 Internal Combustion Engine, the PBL and POPBL is very useful where many assignments and projects will be given to the student. Also for each lecture,

3. Knowledge of education	100
4. Knowledge of general pedagogy	60
5. Knowledge of pedagogy's content	20
6. Knowledge of the curriculum	17
7. Knowledge of vision	10
8. Knowledge of content	10

to critique in free and open professional discourse. I also learned that high-quality professional discourse depends upon the willingness of everyone involved to tolerate a diversity of views and practices.'

Reflection on Action (Hanipah: April, 2007)

I will make a minimum guideline and reiterate core examples so that many students can understand. Plain and comprehensible terms will be used with simple examples to clarify key points. To stimulate advanced students, challenging problem is issued in exams and quizzes. Each class begins with a short review for last class and finalized with summary. I will check student's reaction very carefully, even the smallest detail, in order to improve my lecture.

I hope I can deliver the knowledge to my student clearly and make it to simply understand. Also, after applying the techniques and methods learning, I hope my students can think logically, critical thinking, communication skills, team work and self independently'.

Reflection on Action (Azizul KKTMM 07)

5.3 Students Rating on Diagnostic Questions in HoTS

Over the years, I have worked hard to improve my teaching. For the first semester (Sem II 2003/2005), I used active learning in

my DMV1042 class. I had been quite fortunate to receive good overall ratings from students' evaluation, Figure 1. I thought I will receive lower than that since it was my first semester teaching that subject. Nevertheless, I have used my students' evaluation to my advantage, mainly to find feedbacks to improve my teaching effectiveness. I have carefully studied my student's comments and considered their suggestions. Many have been quite generous to give me good comments. The majority of the students find that active learning to be effective, fun and dynamic. Some of their comments and critics are listed below.

"Even though I found the course material very difficult and sometimes tedious, Sir Ihfan enthusiasm made the course very enjoyable. I felt camaraderie in the class which made it fun and interesting." "Sir Ihfan was very helpful and always available outside of class and I think most students took advantage of this." "The information was clearly presented, Sir Ihfan was available to discuss problems at least 1 hour every day, and I know that he did everything he could to encourage my success." "The lecturer taught very well and clearly. Lots of homework and assignments but now that the term is going to end, I think I learned the material very well." "The group discussion and assignments were helpful. It allowed me to understand problems better."

After finished pedagogy course at UTeM in Jun, 2007, I realize engineering graduate like me could become a great engineering lecturer. I come to a point that my schemata and my prior engineering knowledge about any topic greatly influence what can be learned. And it is through reflective practice. Writing and identify the problem and try to solve it in a very systematic way of doing. Researcher such as Asst. prof. Dr. Hanipah show me how knowledge teaching base store and organized in my memory through knowledge structures or what we call scemata

Reflection on Action – (Muhammad Ihfan Suparman KKTMM 07)

6.0 CONCLUSION

The researcher has discuss this study in two main parts that is:

1. How the researcher does participatory action research and the process that is faced.
2. Discussion on 'Knowing How' and application on constructivism strategy in teaching.

Some difficulty in every spiral had discussed analytically. Grounded Theory and inquiry method had shown clearly. All data used by the researcher and participants to develop new data in their new cycle of action research. The processes carried for two and the half-month.

A few obstacles has been identified like getting the co-operation from 2 out of 46 participants to write reflectively in time.

Nevertheless the main matter that was discussing in the thinking pattern is the self-knowledge of being a reflective lecturer where by new lecturers does have more of this. They are also reported to emphasize values and self-trust, aims and commitment in the subject matter. The researcher has made description about the thinking pattern. The second matter that was discussed by the lecturers is their knowledge about their students. The

research has made detail comparison of each sub category. Thus, the terms 'reflective thinking', 'reflection' and 'reflective practice' are used interchangeably throughout this study to refer to the process lecturers employed as they reviewed, reconstructed, and critically analyzed issues of concern that arose from their field experience. The process is defined as active and critical. Careful consideration is given to knowledge, beliefs, values, feelings and interesting events in light of the grounds, which support them, and in light of their consequences. In summary, the problems that prompted this study include the background of contemporary issues in the professional development of lecturers in Malaysia and the need to explore of how reflection can be facilitated in early profession.

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7.0 BIOGRAPHY



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