

EXPERIENCE OR FORMAL TRAINING?

AN ANALYSIS OF PRE-SERVICE AND IN-SERVICE TEACHER PERFORMANCES

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Introduction

Many teacher training institutions have courses for both pre-service teachers and in-service teachers. Pre-service teachers are primarily drawn from the ranks of university graduates who wish to become teachers. The in-service course trains full-time teachers. The School of Education at the Chinese University of Hong Kong follows this pattern. All teachers-in-training follow the same basic programme of studies with one exception – only the pre-service teachers are required to do a course in Microteaching. The assumption is that the in-service teachers gain a mastery of teaching skills through their daily classroom teaching in conjunction with theory taught during their formal coursework.

Is this assumption valid? How well do the in-service teachers do in comparison with their pre-service counterparts? Although one might expect the daily classroom contact to be of benefit, observations made over several years have indicated that the in-service teachers may actually be learning very little from this contact. The experiment described in this article is an attempt to quantify these observations.

In the training of teachers of Science subjects, skills for the teaching of both theory and practical lessons need to be considered. These are often unrelated. The former are mainly pedagogical in nature whereas the latter are largely organizational. Microteaching, as

described in earlier articles^{1 2}, is an effective means of improving the skills needed for theory lessons. However, microteaching does not enable teachers-in-training to practise those skills needed for laboratory lessons. At present, the only way this is done is by class discussion between tutor and teachers on how to organize practical lessons. Therefore one might expect the in-service teachers, with the benefit of previous laboratory organization, to perform better than pre-service teachers in conducting practical lessons.

In Hong Kong, many teachers are required to be able to teach lessons in the medium of Chinese and in the medium of English. The Microteaching course developed by the author is bilingual in nature. So, although the pre-service teachers have taken this course, the in-service teachers have received little preparation in how to use both languages as media of instruction. Does the language medium used affect the performance of the lessons? This question is also investigated in this study.

With this background in mind, the objectives of the present study are:

1. to compare the performances of pre-service and in-service science teachers in the teaching of both theory lessons and practical lessons.
2. to investigate the effects of medium of instruction on theory and practical lessons.

Design of the Experiment

The subjects used for the study were one-year pre-service course teachers and first-year in-service teachers enrolled in the School of Education Diploma-in-Education programme. In order to obtain groups of sufficient size, the study was conducted over a two-year period (1980–1982). The criteria used each year to select student-teachers for the School of Education were identical so there was no need to regard the subjects in each year as being different. All the student-teachers had completed the same coursework when the study was conducted, except for the Micro-teaching course completed by the pre-service teachers, as discussed above.

Assessment of lessons was carried out by one person. The in-service teachers conducted lessons with their normal classes. The pre-service teachers carried out lessons in schools allocated to them for their 8-week programme of teaching practice. To allow time for the pre-service teachers to establish rapport with their pupils, assessments were made only towards the end of their teaching practice. In this way, an important variable affecting teaching performance was able to be controlled. Assess-

ments were carried out, at random, of theory lessons and practical lessons. This produced a variety of school classes from Form 3 to Form 6, with a variety of topics being taught, some in the medium of English and some in Chinese. All the teachers-in-training were familiar with the criteria for assessment, these having been discussed as part of their Diploma-in-Education Coursework.

Criteria for Assessment

The criteria used to assess teaching performance and the methods of scoring vary widely from one institution to another (Stones and Morris³). In this study, the criteria used for theory lessons are based on the questioning skills used as part of the pre-service teachers' microteaching programme². This is because a high level of performance in questioning skills produces lessons with characteristics believed to be desirable – characteristics such as a reduction in teacher talk, a high degree of pupil participation, and the asking of questions which require high-order, thoughtful responses. Table 1 shows the seven questioning skills assessed. While other criteria are necessary to give a complete assessment – timing and pace

Table 1: The measures used to assess teacher performance in a theory lesson

1. Pausing (3–5 seconds) after asking a question before calling on a pupil to answer.
2. Asking questions that require higher-order responses.
3. Constructing questions that pupils understand, and restructuring these if necessary.
4. Asking good quality questions, i.e. questions not requiring general responses, guesses, or one-word answers.
5. Directing questions to many pupils (including non-volunteers as well as volunteers).
6. Reinforcement of correct responses and treating of incorrect responses in an accepting manner.
7. Probing in order to improve pupils' initial responses (by prompting, asking for further clarification of incomplete responses).

of the lesson, class control, selection and use of aids, effect of personality, and achievement of objectives – they did not form part of this study.

The criteria used to assess performance in conducting practical lessons were developed by the author. Table 2 shows the ten criteria originally selected. Measure number 10 (The

gaining of immediate attention) was not analysed as some of the in-service students had not been assessed on this skill. The remaining 9 measures used can be grouped into broader areas:

1. Pupil involvement in the practical work (measures 1, 2, 3).
2. Skill in class control (measures 4, 5, 6)
3. Ability to organize apparatus and

chemicals for optimal use (measures 7, 8).

4. Teacher-pupil interaction during practical work (measure 9).

Again, there are other areas that could be assessed which are not included in this study – timing, preparation and use of worksheets for example.

Table 2: The measures used to assess teacher performance in a practical lesson

<ol style="list-style-type: none">1. Lesson organized so that pupils are able to think about the experiment while doing it.2. Pupils cooperate with each other in their own groups.3. Pupils are trained to organize their own experimental work, including attention to safety and cleaning up.4. Teacher controls the pupils' entrance to and exit from the laboratory.5. The control of noise level and content.6. The control of pupil movement with the elimination of unnecessary movement around the laboratory.7. Apparatus and chemicals are readily and conveniently available for pupil use.8. Adequate safety precautions have been taken (instructions to pupils, arrangements for handling and disposing of chemicals, ventilation, etc.)9. Teacher assists groups/individuals and questions pupils during practical work.10. The teacher can immediately gain and then keep attention of the class when necessary.
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Scoring Procedure

Assessments by the tutor were carried out while the lessons were actually performed and then completed at the end of the lesson. To allow for the rather impressionistic form of the assessment, a basic three-point scale (1-3-5) was used with the provision of sub-divisions (2, 4) when necessary. This produced a five-point scale:

- 5 – high level of performance – mastery of the measure/skill shown.
- 4 – good
- 3 – acceptable standard – using the skill though with mixed effectiveness
- 2 – weak
- 1 – unsatisfactory standard – unable to perform the skill/measure.

To test the reliability of this scoring

procedure, a second tutor, trained to carry out the same method of assessment, was also present for some of the lessons. The correlation between the scores obtained by the two assessors was high, with the correlation coefficient being 0.89 ($n = 12$ lessons). It was therefore felt that assessment by just one tutor would give reliable results.

Hypotheses

1. On each of the seven measures for theory lessons, it was expected that the pre-service teachers would score higher than the in-service teachers.
2. On the nine measures used to assess practical lessons, it was expected that the pre-service teachers would score lower than the in-service teachers.

3. On each of the seven measures for theory lessons, no significant differences were expected in the scores obtained by in-service teachers between lessons taught in Chinese and those taught in English.
4. On each of the nine measures for practical lessons, no significant differences were expected in the scores obtained by in-service teachers between lessons conducted in Chinese and those conducted in English.

Statistical significance was determined using 't' tests for independent groups at the 0.05 level or less. Because the first two hypotheses are directional in form, one-tailed tests were used for these.

Table 3: Differences in measures of teaching performance for theory lessons between lessons taught by pre-service and in-service science teachers

Measures	Mean Scores			t (df = 64)
	In-service teachers (N = 43)	Pre-service teachers (N = 23)	Difference (Pre-In)	
1. Pausing and naming	2.68	4.22	1.54	4.560***
2. Higher-order questions	2.77	4.48	1.71	6.104***
3. Construction of questions	3.51	4.13	0.62	0.078
4. Quality of questions	2.44	3.52	1.08	3.827***
5. Distribution of questions	2.91	4.39	1.48	4.284***
6. Treatment of responses	3.09	4.39	1.30	4.915***
7. Probing	2.48	3.96	1.48	4.464***

***p < 0.001; one-tailed

On 5 of the 7 measures, the mean score for pre-service teachers was more than 4.00 (maximum of 5). This indicates a high level of performance in theory lessons. For the in-service teachers however, the mean score on 5 of the 7 measures was below 3.00 indicating that they are barely reaching an acceptable level of performance. In the important skill "asking questions that require higher-order questions", it is clear that the pre-service teachers are better at this (in quantity and quality of questions) than the in-service teachers.

The in-service teachers score highest on

Results and Discussion

A. Comparing theory lessons of pre-service and in-service teachers

For each of the 7 measures, an analysis was made of the mean differences between the lessons taught by the pre-service teachers and those taught by the in-service teachers. Table 3 summarizes the outcome of the analyses.

On all 7 measures, the pre-service teachers have performed better than their in-service counterparts. And except for one measure (construction of questions) all these differences are statistically significant.

"constructing questions that pupils understand, and restructuring these if necessary". This is because they tend to ask simpler, lower-order questions which are easier to construct and more easily understood by pupils.

The differences in performances must be due to two reasons:-

1. Pre-service teachers, though lacking in experience, are benefiting from the skills training received through their microteaching programme,

2. In-service teachers, though receiving no formal skills training, are not able to improve

their teaching performance on the basis of experience and mere class discussion of teaching techniques.

In order to improve the performance of in-service teachers in theory lessons, it is necessary to make Microteaching a required part of their Diploma programme.

B. Comparing practical lessons of pre-service and in-service teachers

For each of the 9 measures, an analysis was made of the mean differences between the practical lessons conducted by the pre-service teachers and those conducted by the in-service teachers. The results of the analyses are summarized in Table 4.

On 6 of the 9 measures, the pre-service teachers scored lower than the in-service teachers, as hypothesized. However, on only 3 of these measures were the differences statistically significant. Two of

these significant differences relate to "class control". It is clear that the pre-service teachers have greater difficulty controlling pupils in the laboratory. This is partly due to the temporary nature of their position in the schools.

On all measures – for both pre-service and in-service teachers – the mean scores are 3.00 or higher. This indicates that a good level of performance is being obtained based solely on formal class discussions of the measures needed to conduct an effective laboratory lesson. The additional experience possessed by the in-service teachers does not appear to give them much advantage except in the area of "class control" and it is often the authority of the position held by the teacher rather than the teacher himself that contributes most to his ability to control the noise, activity, and movement of pupils in a laboratory.

Table 4: Differences in measures of teaching performance for practical lessons between lessons conducted by pre-service and in-service teachers

Measures	Mean Scores			t (df = 55)
	In-service Teachers (N = 42)	Pre-service Teachers (N = 15)	Difference (Pre-In)	
1. Pupils show evidence of thinking about the experiment	3.43	3.53	0.10	1.404
2. Pupils cooperate within groups	4.20	3.66	- 0.54	1.656
3. Pupils organize practical work	4.08	3.66	- 0.42	1.244
4. Control of pupils entering/leaving the laboratory	4.38	3.00	- 1.38	4.396***
5. Control of noise	3.76	3.00	- 0.76	1.774*
6. Control of pupil movement	3.62	3.13	- 0.49	1.348
7. Availability of apparatus/chemicals	4.68	4.06	- 0.62	2.184*
8. Safety precautions	4.33	4.73	0.40	1.482
9. Teacher assistance	3.88	4.33	0.45	1.547

*p < 0.05; **p < 0.01; ***p < 0.001; one-tailed

On the measure of “teacher assistance”, the pre-service teachers perform better than the in-service teachers, though the difference is not significant (with the sample sizes used). This is probably due to their superior ability to ask questions and hence less reluctance to do this when pupils are working by themselves or in groups.

C. The effects of language medium on the lessons of in-service teachers

For each of the 16 measures (for both theory and practical lessons), an

analysis was made of the mean differences between the lessons taught in Chinese and those taught in English by in-service teachers. No analysis was done for pre-service teachers as there were too few lessons conducted in English to give a meaningful comparison. The difference between the mean scores on each measure was small and only 3 of the 16 differences were significant. Thus the results tend to reflect the predictions made in the hypotheses. Table 5 summarizes the outcome of the analyses for the significant differences only.

Table 5: Significant differences in teaching performance by in-service teachers between lessons taught in Chinese and in English

Measures	Mean Scores			t (df = 41)
	Lessons in Chinese (N = 25)	Lessons in English (N = 18)	Difference (English-Chinese)	
1. Pausing and naming (theory 1)	2.36	3.12	0.76	2.209*
2. Higher-order questions (theory 2)	2.44	3.22	0.78	2.257*
3. Availability of apparatus/ chemicals (practical 7)	4.63	4.73	0.10	2.399*

*p < 0.05; two-tailed

Performance on the skill of “pausing and naming” is better when English rather than Chinese is used. This result agrees with earlier work done on an analysis of questioning skills of pre-service teachers.² The reason for this is probably because of the reluctance of pupils to answer questions in English thus producing a longer pause. In addition, the teacher will have to name a pupil in order to elicit any response. Teachers also ask significantly more higher-order questions when using English though it is difficult to find a suitable explanation for this.

For practical lessons, only the measure of “availability of apparatus/chemicals” shows a significant difference. However

the size of this difference is small and is of no practical significance. The similar results obtained for most measures in both languages are not unexpected as oral language use by the teacher is not as great as in a theory lesson.

Conclusions

This study shows that science teachers-in-training who lack teaching experience but have taken a programme of microteaching give higher quality theory lessons than do others who have greater teaching experience but have had no formal opportunity to consciously practise classroom teaching skills. This is further evidence as to the effectiveness of microteaching

in improving the level of (questioning) skills of teachers. It is therefore hard to escape the conclusion that for most teachers, experience per se is insufficient in helping them to improve their ability at classroom teaching. Some form of skills training should therefore be included in all in-service programmes of teacher education as well as in pre-service programmes. The conclusion also leads one to suspect that many Diploma holders may not actually be teaching much better than before they began their studies, although they may have a greater awareness of the teaching and learning processes!

In conducting practical science lessons, this study shows again that experience is not of any significant advantage. In-service teachers do not perform significantly better than pre-service teachers in most aspects of laboratory teaching. All teachers-in-training who have completed formal classwork on how to conduct practical lessons achieve at least an "acceptable" grade when such lessons are assessed.

Finally, the study shows that whether

Chinese or English is used as the medium of instruction, very little difference is observed in the teaching performance of teachers (even though the use of English may produce undesirable effects on measures not investigated in this present work).

References

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