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# A Preliminary Study on the Development of Pedagogical Content Knowledge among Economics and Primary Social Studies Student Teachers in Singapore

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## Introduction

In this preliminary study on the development of pedagogical content knowledge among student teachers in the National Institute of Education, Singapore, Economics and Primary Social Studies student teachers self-report their progress in their professional development upon exit of teacher training using a survey instrument adapted from Ho's (2003) pedagogical content knowledge development model.

The purpose of this study is to use data on the student teachers' perceived accumulation of pedagogical content knowledge to throw light on the effectiveness in the teaching areas of Economics and Primary Social Studies in order to better develop pedagogical content knowledge among student teachers.

## Pedagogical Content Knowledge

Pedagogical content knowledge is that unique professional understanding that allows teachers to integrate, transform and represent subject matter knowledge in ways that students can understand. Shulman (1987) defined pedagogical content knowledge as

> Identify[ing] the distinctive bodies of knowledge for teaching. It represents the blending of content and pedagogy into an understanding of how particular topics, problems or issues are organized, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction. Pedagogical content knowledge is the category most likely to distinguish the understanding of the content specialist from that of pedagogue. (p. 8)

Often, teachers develop their pedagogical content knowledge through their practical experiences. It is therefore important and necessary to provide teachers the opportunities, time, reasons and mechanisms for them to engage in dialogues and discussions that would help them to articulate their pedagogical content knowledge gained from their practical experiences. In essence, it is necessary to assess and measure the development of pedagogical content knowledge. For teacher educators, preliminary findings of how pedagogical content knowledge has been achieved by student teachers would guide in the design and implementation of teacher education for student teachers.

## Conceptual Model

This preliminary study uses an adaptation of the pedagogical content knowledge developmental model conceptualized by Ho (2003) to obtain information on how student teachers perceive themselves in the different dimensions of pedagogical content knowledge. The pedagogical content knowledge developmental model was chosen as it would provide a relatively comprehensive analysis of the various dimensions of pedagogical knowledge of student teachers. In addition, the model was conceptualized in the same context, in Singapore. As such, this model would be relevant in determining student teachers' perceived pedagogical content knowledge.

Ho (2003) conceptualized three distinct phases; namely, the "Mimicry phase," the "Motivation phase," and the "Mastery phase" based on a qualitative study of 12 teachers (4 participants in each of the three categories). He categorized the participants into three categories: "Beginning Teachers" (student teachers), "In-Betweens" (teaching experiences range from 3 to 5 years), and "Experienced Teachers" (teaching experiences range from 10 to 17 years). Each phase is further sub-divided into different stages. The "Mimicry phase" has two stages: the "Ignorance stage" where teachers have no knowledge of the various categories in the pedagogical content knowledge developmental model and "Imitation stage" where teachers simply do as told, not knowing the reasons for doing so. The "Motivation phase" has three stages: the "Interest stage," the "Information stage," and the "Involvement stage." The "Interest stage" is where teachers know that they have to find out more about what they do not know. In the "Information stage," teachers broaden their knowledge base and understand the rationales for different approaches. In the "Involvement stage," teachers move into trying out and experimenting with various approaches. The "Mastery phase" consists of the "Internalisation stage" where teachers form a coherent knowledge base for teaching purposes and the "Integration stage" where teachers are able to make interdisciplinary links. For each of these stages in each dimension (curricula, student conceptions, representations, subject matter, general pedagogy, content and purpose) of pedagogical content knowledge, a qualitative descriptor is provided. The pedagogical content knowledge developmental model by B.T. Ho (2003) can be found in Appendix A.

## Methodology

A survey instrument was crafted by adapting the pedagogical content knowledge developmental model to record student teachers' perception of their pedagogical content knowledge upon exit of their teacher training. To enable student teachers to comprehend the various dimensions in the survey instrument, the descriptors were worded using terms they would be familiar with. There are five dimensions in the survey instrument:

- The scheme of work (curriculum plan);
- Awareness of the students' profile and taking into account student diversity in lesson delivery;
- Lesson delivery and knowledge of the rationale for instructional procedures.
- Subject matter knowledge and the teachers' knowledge of curriculum content; and
- General pedagogy and knowledge of the various approaches that can be used in teaching the subject matter.

Student teachers reported their perceptions in the above five dimensions on a seven-stage scale showing increasing levels of competencies which are grouped into three phases of "Mimicry," "Motivation," and "Mastery."

The participants in this study were student teachers in the Postgraduate Diploma in Education programme in the academic year 2010/2011. The National Institute of Education (NIE) is the only teacher education institution in Singapore. Applicants are interviewed by the Ministry of Education and typically given a stint of teaching in local schools as "contract-untrained teachers" to discover whether teaching is suitable for them. There is no formal training during this period. After the stint as "contract-untrained teachers," successful applicants then go for a one-year training at NIE before re-entering local schools as trained beginning teachers.

All Economics student teachers were in the Postgraduate Diploma in Education programme. Among the 55 Economics student teachers in this study, most were local graduates, seven were from overseas universities like Stanford, Cambridge and the London School of Economics and eight were graduates from Indian universities. 24 were on Ministry of Education teaching awards or scholarships.

The primary Social Studies student teachers in the Postgraduate Diploma in Education programme were all graduates and had obtained their basic degrees (mainly in business, psychology and engineering) from various universities in Singapore and overseas.

The focus of the study was to examine the differences in the perceptions of student teachers of their competencies in their pedagogical content knowledge before they commenced their course in NIE and after they had completed their teaching practice in schools. The survey was administered immediately after their teacher training as this would provide student teachers with the opportunity to rate their progress from the beginning to the end of their teacher training. The rationale for data collection at a single point in time is that before teacher training, student teachers could not be expected to know what they did not know. Two sets of data were collected for Economics and Primary Social Studies respectively. The survey instrument can be found in Appendix B.

## Findings

### *Perceptions of Economics student teachers*

Table 1 shows the student teachers' initial self-ratings. These were their perceptions of their competencies in the five dimensions of scheme of work, student profile, subject matter, general pedagogy and lesson delivery before they started their courses at NIE. Table 1 also shows a breakdown of the responses according to the student teachers' length of pre-NIE teaching experience as contract-untrained teachers in local schools. Table 2 tabulates their perceptions of their competencies after NIE training.

The initial self-ratings for the five dimensions suggest that student teachers perceived themselves as having greater knowledge of lesson delivery, student profile and general pedagogy than in the subject matter and scheme of work at the start of their NIE training. The observations above also suggest that student teachers mostly perceived

themselves as novices irrespective of the length of their pre-NIE teaching experience.

**Table 1: Student teachers' perceptions of their initial competencies**

| Dimension / Initial self-ratings | Scheme of Work | Student Profile | Subject Matter | General Pedagogy | Lesson Delivery |
|---|---|---|---|---|---|
| Mimicry phase | 48<br>87.3% | 35<br>63.6% | 42<br>76.4% | 36<br>65.5% | 32<br>58.2% |
| Motivation phase | 7<br>12.7% | 20<br>36.4% | 12<br>21.8% | 19<br>34.5% | 22<br>40.0% |
| Mastery phase | 0% | 0 | 1<br>1.8% | 0 | 1<br>1.8% |

**Table 2: Student teachers' perceptions of their competencies after NIE training**

| Initial phase to final phase | Scheme of Work | Student Profile | Subject matter | General Pedagogy | Lesson delivery |
|---|---|---|---|---|---|
| Mimicry to motivation | 41<br>74.5% | 19<br>34.5% | 34<br>61.8% | 18<br>32.7% | 9<br>16.4% |
| Mimicry to mastery | 4<br>7.3% | 16<br>29.1% | 10<br>18.2% | 17<br>30.9% | 23<br>41.8% |
| Motivation to mastery | 4<br>7.3% | 14<br>25.5% | 6<br>10.9% | 10<br>18.2% | 18<br>32.7% |
| Movement from mastery to motivation | 0 | 0 | 0 | 0 | 1<br>1.8% |
| Missing data on post-NIE training perception | 0 | 0 | 0 | 1<br>1.8% | 0 |

*There was one instance of post-training level rated lower than pre-training level.

For each dimension, more than 50% of the student teachers indicated their initial position as that of the mimicry phase. For instance, when asked about their ability to develop a scheme of work, 87.3% of student teachers perceived themselves to be at the mimicry phase. This suggests that student teachers were aware of their lack of exposure and experience in crafting and implementing the scheme of work. This is in large part due to the fact that schools typically involve only trained teachers in

designing their curriculum.

Notably, in terms of subject matter knowledge, 76.4% of student teachers rated themselves at the mimicry phase. This is surprising because subject mastery is expected of student teachers as all the students have a university degree in Economics; they are assumed to have at least a basic level of subject mastery adequate for teaching Economics at GCE 'A' level. However, many student teachers feel that they have an uneven mastery of economic theories to be taught at GCE 'A' level. This is because at undergraduate level, tertiary students can choose their courses from a vast variety of combinations of courses which may not necessarily equip them to teach the GCE 'A' level Economics syllabus.

Relatively fewer students (63.6%) felt that they were at the mimicry phase in terms of understanding their students' profiles, general pedagogy and knowledge of lesson delivery. Their classroom experiences during contract teaching might also account for their higher level of confidence in this dimension than in subject matter and scheme of work. The data in Table 1 does not show that those with a longer pre-NIE teaching stint necessarily perceived themselves to be beyond the mimicry phase. While it is plausible that accumulation of pedagogical content knowledge might have started in the student teachers' pre-NIE teaching stint, student teachers may perceive themselves as novices irrespective of the length of their pre-NIE teaching experience.

The data from Table 2 showed that there was a significant increase of 74.5% from mimicry to motivation for scheme of work. This corresponded to student teachers' feedback on the usefulness of specific assignments in the Economics courses which gave them a better appreciation of the crafting and implementation of the scheme of work. These assignments required them to unpack the syllabus, and to plan and deliver lessons on specific topics in the scheme of work. However, since student teachers were not required to craft schemes of work from scratch, few of them could be expected to perceive themselves as having mastered this dimension. Thus, it is not surprising that only 14.6% of the student teachers rated themselves to have attained mastery as curriculum gatekeepers in drawing up and implementing the scheme of work.

In terms of subject matter knowledge, 34 of the 55 student teachers (61.8%) reported a move to the motivation phase. Another 18.2% perceived that they had progressed to the mastery phase. Subject matter is woven into Economics courses in assignments as well as class discussions. Four weeks before the curriculum studies courses, student teachers were grouped to revise the entire GCE 'A' level syllabus. Student teachers reported in their end-of-semester course evaluation that such assignments and post-assignment feedback from peers and course instructors strengthened their subject mastery considerably. Similarly, in terms of knowledge of the profile of students, 29.1% perceived themselves to have progressed from mimicry to mastery and 34.5% saw themselves as having moved from mimicry to motivation. Student profiling was included in discussions in the pedagogy course on the principles of engaged learning, teaching strategies and lesson planning, as well as assignments for motivation (case studies and plan for students' success in Economics).

While 32.7% reported progress from mimicry to motivation for general pedagogy and lesson delivery, a total of 49.1% perceived that they had reached mastery phase. An even higher percentage (74.5%) perceived themselves to have reached mastery in lesson delivery. This may be attributed to the explicit teaching and hands-on practices on teaching concepts and a range of pedagogies like cooperative learning, questioning and lectures. Another important contributor is the 10-week teaching practice during which they personally planned and delivered all their lessons which would have closed many gaps between theory and practice in these two dimensions.

### *Perception of Primary Social Studies Teachers*

Table 3 shows the 14 student teachers' initial self-ratings and perceptions of their competencies in the five dimensions of scheme of work, student profile, subject matter, general pedagogy and lesson delivery before they started their courses at NIE. Table 4 tabulates their perceptions of their competencies after NIE training.

**Table 3: Student teachers' perceptions of their initial competencies**

| Dimensions / Initial self-ratings | Scheme of Work | Student Profile | Subject Matter | General Pedagogy | Lesson Delivery |
|---|---|---|---|---|---|
| Mimicry phase | 13<br>92.9% | 10/14<br>71.4% | 13/14<br>92.9% | 12/14<br>85.7% | 9/14<br>64.3% |
| Motivation | 1<br>7.1% | 4<br>28.6% | 1<br>7.1% | 2<br>14.3% | 5<br>35.7% |
| Mastery | 0 | 0 | 0 | 0 | 0 |

**Table 4: Student teachers' perceptions of their competencies after NIE training**

| Initial phase to final phase | Scheme of Work | Student Profile | Subject matter | General Pedagogy | Lesson delivery |
|---|---|---|---|---|---|
| Mimicry to motivation | 12<br>85.8% | 4<br>28.6% | 11<br>78.7% | 5<br>35.7% | 1<br>7.1% |
| Mimicry to mastery | 1<br>7.1% | 0 | 1<br>7.1% | 2<br>14.3% | 8<br>57.2% |
| Motivation to mastery | 1<br>7.1% | 5<br>35.7% | 0 | 7<br>50% | 5<br>35.7% |

All the student teachers have had some form of teaching experience (contract and relief teaching) of at least 4 months prior to attending the course at NIE. However, most of the student teachers perceived themselves at the mimicry phase regardless of the duration of their prior teaching experience. For each dimension,

more than 60% of the student teachers indicated their initial position as that of the mimicry phase. The highest rated dimension for the motivation phase is that for lesson delivery. None of the student teachers positioned themselves at the mastery phase for all five dimensions.

Almost all (92.9%) of the student teachers perceived themselves to be at the mimicry phase in terms of their knowledge of developing a scheme of work. In contrast, 71.4% of student teachers considered themselves to be at the mimicry phase in terms of their knowledge of the different profiles of their students. This can be partly attributed to the student teachers having more teaching experience in schools and having the opportunity to interact with diverse students in a class Four student teachers who placed themselves at the motivation phase. Notably, 92.9% of student teachers rated themselves at the mimicry phase for subject matter knowledge. This is not surprising as most of the student teachers graduated with a basic degree in business, engineering and psychology – disciplines that are not particularly relevant to the school subject.

Finally, in terms of their knowledge of general pedagogy and lesson delivery, 85.7% and 64.3% of student teachers positioned themselves at the mimicry phase. Based on the data presented in Table 3, there does not seem to be any correlation between the teaching experience of the student teachers and their perception of their initial competencies in the five dimensions. The data presented in Table 4, however, suggests that after the pre-service courses, more than half of the students reported a shift in their self-perceptions of knowledge of lesson delivery, general pedagogy, and developing a scheme of work.

Almost 86% of the student teachers reported a shift from mimicry to motivation for scheme of work. This corresponded to the student teachers' experience in their curriculum studies course on unit and lesson planning using a curriculum framework. Student teachers became more confident in being curricular-instructional gatekeepers and in making educational decisions (Thornton, 1991). For instance, student teachers learned that they could rearrange the order of the topics, use other sources besides the textbooks and workbooks, and provide multiple perspectives by bringing in alternative sources. The student teachers spent at least 9 hours conceptualizing a unit of study. Since student teachers were not required to craft schemes of work from scratch, few of them could be expected to perceive themselves as having mastered this dimension. Thus, it is not surprising that only 14.2% of student teachers rated themselves to have attained mastery in designing and implementing the scheme of work.

Differentiated instruction was introduced explicitly in the final course. However, student teachers have indicated in their feedback that they found the strategies pertaining to differentiated instruction most difficult to understand and use in lesson planning. As a result, 28.6% of student teachers perceived themselves to have progressed from mimicry to motivation and 35.7% saw themselves as having moved from motivation to mastery.

In terms of subject matter knowledge, 78.7% of student teachers reported a move to the motivation phase. This could be attributed to the subject matter being woven into the curriculum studies courses rather than being explicitly taught. Interestingly, 64.3% of the student

teachers perceived that they had reached mastery phase for general pedagogy. Student teachers' knowledge of general pedagogy was heightened in the curriculum studies course that emphasized the use of a variety of pedagogical approaches. Another important contributor would be the ten-week teaching practice during which they personally planned and delivered all their lessons which would have closed many gaps between theory and practice. Similarly, 92.9% of the student teachers perceived that they had reached mastery phase for lesson delivery with only 7.1% still at the motivation phase.

The findings suggest that the student teachers felt that they acquired a lot of knowledge about developing a scheme of work, lesson delivery and general pedagogy. Feedback from student teachers indicated that they found the curriculum studies courses provided them with a clear understanding of the knowledge and skills needed to teach the subject. Useful and practical teaching strategies were taught in the courses and they were able to use these strategies in their teaching practice.

## Conclusion

The purpose of this study was to try to evaluate the effectiveness of the Economics and Primary Social Studies curriculum studies courses in developing pedagogical content knowledge among the student teachers. However, the use of student teachers' perceptions of their accumulation of pedagogical content knowledge to throw light on the effectiveness of the curriculum studies courses in Economics and Primary Social Studies is limited in several ways. Firstly, as perceptions are subjective and while data may be internally consistent for each student teacher, such findings are not generalizable since the student teachers' self-ratings are not calibrated by objective benchmarks. Student teachers, in addition, may perceive they have mastered a certain dimension of teaching but they may still be far off from mastery. Similarly, student teachers who rated themselves as still in the mimicry phase may in reality be better equipped than those who feel they have moved to a higher phase and though student teachers mostly perceived themselves as novices irrespective of the length of their pre-NIE teaching experience, their accumulation of pedagogical content knowledge could have already taken place during their pre-NIE training stint.

This data provides useful information for Economics teacher educators to develop courses that better meet student teachers' needs. Firstly, course components which have been effective in building up student teachers' competencies in lesson delivery, general pedagogy and student profile may be retained and enhanced. Next, student teachers' perceived mastery of subject matter may be strengthened through deliberate teaching or revisiting of content during Economics courses. As for scheme of work, the Economics courses could be re-designed to give explicit teaching to acquire the skills of designing and implementing a scheme of work if these are considered necessary skills of beginning teachers.

Finally, this preliminary study seems to indicate that the NIE Primary Social Studies curriculum studies courses are fairly effective in helping student teachers improve their pedagogical content knowledge. The data suggests that the Primary Social Studies curriculum studies courses should give greater emphasis to

subject matter knowledge and teaching student teachers how to develop curricular schemes of work. For instance, basic curriculum design skills could be taught explicitly and content deliberately interwoven with pedagogical studies during Primary Social Studies courses in order to raise the level of content mastery.

## References

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# Appendix A

## PCK Development Model (Ho, 2003)

Pedagogical Content Knowledge (PCK) Developmental Model © (Ho, 2003)

| PHASE | Developmental Stages | Teacher Knowledge including Categories of Pedagogical Content Knowledge (PCK) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Curricula | Student Conceptions | Representations | Subject Matter | General Pedagogy | Context | Purpose |
| MIMICRY | 1. Ignorance | Is unable to organise knowledge into a scheme of work | Does not consider students and their conceptions | Has little or no knowledge of representations | Does not have the necessary conceptions | Has limited or no awareness of strategies | Is insensitive to context | Doesn't know why he's doing what he's doing |
| | 2. Imitation | Adopts readily available scheme of work | Considers students and their conceptions but treats them equally | Uses readily available representations | Accepts presented information as truth | Copies others' styles without understanding | Apply same knowledge to all contexts | Does as told and accepts reason for doing so |
| MOTIVATION | 3. Interest | Is keen to explore alternative ways of organising knowledge | Becomes aware of individual differences among students | Is keenly interested in accumulating resources | Becomes aware of contradictions or alternatives | Is curious about various approaches | Is sensitive to contextual influence | Wants to know the reasons why |
| | 4. Information | Learns more about knowledge organisation | Becomes more informed about students and their conceptions | Learns more about multiple representations | Gathers more information about them | Learns about the various approaches | Gathers more information about the context | Questions why things are done the way they are |
| | 5. Involvement | Experiments with different schemes | Tries individualising instruction | Constantly seeks new representations | Verifies that information is true | Tries out various approaches | Works with various contexts | Explores other reasons |
| MASTERY | 6. Internalisation | Develops a coherent knowledge base for teaching purposes | Builds up good working knowledge with students | Acquires a wide repertoire of representations | Forms a coherent knowledge base | Gains a wide repertoire of strategies | Is fully aware of contextual variables | Is convinced of reasons for doing so |
| | 7. Integration | Is able to make interdisciplinary links for teaching purposes | Is able to activate student learning and conceptions | Generates new representations | Has good interdisciplinary knowledge bases | Chooses wisely to suit context | Responds to contextual changes | Views reasons as part of a bigger whole |

## Appendix B

### Survey Instrument Used

Survey on Student Teachers' Pedagogical Content Knowledge (PCK)

This is a survey to compare your perception of your knowledge, skills and dispositions towards (subject) BEFORE you embarked on this course and AFTER your teaching practice

For each of the items below, please read the 7 statements. In the respective columns, tick only ONE statement that best describes your knowledge, skills and dispositions towards (subject)

| S/N | | Item | Before courses | After teaching practice |
|---|---|---|---|---|
| **Scheme of Work** | | | | |
| Mimicry | 1 | Has little awareness of how to organise knowledge into a Scheme of Work | | |
| | 2 | Uses Scheme of Work developed by others | | |
| Motivation | 3 | Is keen to explore alternative ways of organising knowledge | | |
| | 4 | Learns more about how to develop a Scheme of Work | | |
| | 5 | Experiments with different Schemes of Work | | |
| Mastery | 6 | Is able to develop a coherent Scheme of Work independently | | |
| | 7 | Is able to make interdisciplinary links in the Scheme of Work independently | | |
| **Student Profile (Interest, Learning Style and Prior Knowledge)** | | | | |
| Mimicry | 1 | Has little awareness of the need to give consideration to student profile in lesson planning | | |
| | 2 | Uses lesson plans developed by others which give consideration to student profile | | |
| Motivation | 3 | Becomes aware of individual differences among students | | |
| | 4 | Becomes more informed about student profile | | |
| | 5 | Tries individualising instruction | | |
| Mastery | 6 | Is able to incorporate individualised instruction according to student profile in lesson planning | | |
| | 7 | Is able to implement individualised instruction according to student profile | | |

| S/N | | Item | Before courses | After teaching practice |
|---|---|---|---|---|
| | | | | |
| **Subject Matter** | | | | |
| Mimicr | 1 | Has little awareness of the requirements of the subject syllabus | | |
| | 2 | Teaches according to the subject syllabus | | |
| Motivation | 3 | Becomes aware of contradictions or alternatives in real-world applications of the subject | | |
| | 4 | Gathers more information about the contradictions or alternatives in real-world applications of the subject | | |
| | 5 | Tries to make meaning of additional information in real-world applications | | |
| Mastery | 6 | Has developed deep knowledge of the subject | | |
| | 7 | Is able to make links with real-world issues through interdisciplinary knowledge bases | | |
| **General Pedagogy** | | | | |
| Mimicr | 1 | Has limited awareness of strategies | | |
| | 2 | Copies others' strategies without understanding | | |
| Motivatio | 3 | Is curious about various strategies | | |
| | 4 | Learns about various strategies | | |
| | 5 | Tries out various strategies | | |
| Mastery | 6 | Has gained a wide repertoire of strategies | | |
| | 7 | Is able to chooses strategies wisely to suit context | | |
| **Purpose of actions taken during lesson delivery** | | | | |
| Mimicr | 1 | Has little awareness of the purpose of actions taken during lesson delivery | | |
| | 2 | Does as told and accepts reasons for actions taken during lesson delivery | | |
| Motivatio | 3 | Wants to know the reasons for actions taken during lesson delivery | | |
| | 4 | Questions why these actions are taken during lesson delivery | | |
| | 5 | Explores other reasons for actions taken during lesson delivery | | |
| Mastery | 6 | Is able to justify the reasons for actions taken during lesson delivery | | |
| | 7 | Is able to use a repertoire of actions during lesson delivery that suit context | | |

Thank you for your cooperation!
Adapted from: Ho, B.T. (2003).Development of Pedagogical Content Knowledge (PCK).Unpublished doctoral dissertation. Singapore: Nanyang Technological University