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PEDAGOGICAL CONTENT KNOWLEDGE OF MATHEMATICS GROUP B.Ed TRAINEES

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ABSTRACT

This paper attempts to find out the level of pedagogical content knowledge of mathematics group B.Ed trainees. Pedagogical Content Knowledge Scale (PCKS) was developed and validated. 610 mathematics group B.Ed. trainees were selected randomly for this study. The findings of the study revealed that the female mathematics group B.Ed. trainees are better in their pedagogical content knowledge. The women's and aided college mathematics group B.Ed. trainees are better in their pedagogical content knowledge.

PEDAGOGICAL CONTENT KNOWLEDGE (PCK)

The concept of pedagogical content knowledge is not new. The term gained renewed emphasis with Lee Shulman (1986), a teacher education researcher who was interested in expanding and improving knowledge on teaching and teacher preparation that, in his view, ignored questions dealing with the content of the lessons taught. Shulman defined pedagogical content knowledge as teachers' interpretations and transformations of subject-matter knowledge in the context of facilitating student learning. He further proposed several key elements of pedagogical content knowledge:

(i) Knowledge of representations of subject matter (content knowledge)

(ii) Understanding of students' conceptions of the subject and the learning and teaching implications that were associated with the specific subject matter

(iii) General pedagogical knowledge (or teaching strategies).

To complete what he called the knowledge base for teaching, he included other elements:

(i) Curriculum knowledge

(ii) Knowledge of educational contexts

(iii) Knowledge of the purposes of education (Shulman, 1987).

The following paradigm clearly indicates the relationship and play between content knowledge and pedagogical knowledge.

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PEDAGOGICAL CONTENT KNOWLEDGE OF MATHEMATICS GROUP B.Ed. TRAINEES

Mathematics relies heavily on the preparation that the teacher has, in his own understanding of mathematics, of the nature of mathematics, and in his bag of pedagogic techniques. Textbook-centered pedagogy dulls the teacher's own mathematics activity. A mathematics teacher trainee needs to know the fundamental concepts of mathematics, its origin, the interesting facts about them and the continuity in concept formation and presentation. In addition to that, a mathematics teacher trainee needs to know what models and explanations support learning, and also ensure that such models and analogies effectively convey the content ideas. Similarly, it is essential for a mathematics group teacher trainee to understand typical student conceptions, and why these conceptions might be held, and this understanding does not rely on discipline knowledge alone. Teachers also need to be able to determine what makes a task complex or easy.

SIGNIFICANCE OF THE STUDY

It is agreed that teachers' professional knowledge, which is the knowledge base of teaching, is an amalgamation of different forms of knowledge. There are different ways of classifying the knowledge base of teaching. One of the most influential classification is suggested by Shulman (1986), who distinguishes several components of the knowledge base of teaching as subject matter knowledge, pedagogical content knowledge, general pedagogical knowledge and knowledge of educational aims. In Shulman's theoretical framework, teachers need to master two types of knowledge (i) Content, also known as "deep" knowledge of the subject itself and (ii) Knowledge of the curricular development. Content knowledge encompasses Bruner's "structure of knowledge"–the theories, principles, and concepts of a particular discipline. Especially important is content knowledge that deals with the teaching process, including the most useful forms of representing and communicating content and how best the students learn the specific concepts and topics of a subject.

If one talks about mathematics teaching, it is a complex task to achieve. Mathematics education is a science like pure mathematics. Although mathematics and mathematics education have a dynamic interaction with each other, they have different aspects as well. One of the most common debates among pure mathematicians and mathematics educators is 'whether having a deep understanding of mathematics is sufficient to teach mathematics?'. In order to find and answer this question, the division between pure mathematics and mathematics education need to be bridged. A deep understanding of mathematical

knowledge is necessary but not sufficient to teach mathematics. Additionally, it is not possible to teach mathematics without having mathematical knowledge as well. Mathematics teachers must be educated both from mathematics knowledge and pedagogical content knowledge aspects. So through this study, the investigator wants to find out the Pedagogical Content Knowledge of mathematics group B.Ed trainees.

STATEMENT OF THE PROBLEM

Pedagogical Content Knowledge of Mathematics Group B.Ed trainees.

OBJECTIVE

1. To find out the level of pedagogical content knowledge of mathematics group B.Ed. trainees.

HYPOTHESES

1. There is no significant difference between male and female mathematics group B.Ed. trainees in their knowledge on philosophy and sociology, curriculum and instruction, methodology, techniques, communication, technology, psychology, evaluation, content and pedagogical content knowledge.
2. There is no significant difference between rural and urban mathematics group B.Ed. trainees in their knowledge on philosophy and sociology, curriculum and instruction, methodology, techniques, communication, technology, psychology, evaluation, content and pedagogical content knowledge.
3. There is no significant difference between the mathematics group B.Ed. trainees from aided and self-financed colleges of education in their knowledge on philosophy and sociology, curriculum and instruction, methodology, techniques, communication, technology, psychology, evaluation, content and pedagogical content knowledge.
4. There is no significant difference among mathematics group B.Ed. trainees from men's, women's and co-education colleges of education knowledge on philosophy and sociology, curriculum and instruction, methodology, techniques, communication, technology, psychology, evaluation, content and pedagogical content knowledge.

METHOD USED FOR THE STUDY

The investigator has used survey method to study the pedagogical content knowledge of mathematics group B.Ed. trainees.

POPULATION AND SAMPLE

The population for the study includes the Bachelor of Education students who have taken mathematics education as their optional in the autonomous, government-aided and self-financed colleges of education affiliated to the Tamilnadu Teachers Education University,

Chennai from Thoothukkudi, Tirunelveli and Kanyakumari districts. The investigator used stratified random sampling technique for selecting the sample. The investigator randomly selected thirty nine colleges of education from the total seventy one colleges of education at Thoothukudi, Tirunelveli and Kanyakumari districts. From these colleges of education, by stratification, 610 mathematics group B.Ed. trainees were selected for this study.

TOOL USED

To measure the pedagogical content knowledge of mathematics group B.Ed. trainees, the investigator and the guide developed Pedagogical Content Knowledge Scale (PCKS) in the year 2010. The investigator prepared 133 items, in which 89 items were based on pedagogical knowledge and 44 items were based on content knowledge. After the item analysis, the final tool consisted of 70 items in which 50 items were based on pedagogical knowledge and 20 items were based on content knowledge. The investigator established the content validity and criterion referenced validity (0.74). Test-retest method was employed to establish reliability of the tool. It is found to be **0.77**.

The PCKS includes the dimensions namely knowledge on philosophy and sociology, curriculum and instruction, methodology, techniques, communication, technology, psychology, evaluation and content. In this scale, all the items were objective type with multiple choices. The correct answer is given one mark where as wrong answer is given zero mark. Percentage Analysis, 't' test, ANOVA were employed for analysis of data.

TABLE 1

LEVEL OF PEDAGOGICAL CONTENT KNOWLEDGE OF MATHEMATICS GROUP B.ED. TRAINEES

Pedagogical Content Knowledge and its Dimensions	Low		Moderate		High	
	N	%	N	%	N	%
Philosophy and Sociology	68	11.1	386	63.3	156	25.6
Curriculum and Instruction	134	22.0	339	55.6	137	22.4
Methodology	197	32.3	322	52.8	91	14.9
Techniques	189	31.0	356	58.4	65	10.6
Communication	179	29.3	327	53.6	104	17.1
Technology	182	29.8	350	57.4	78	12.8
Psychology	208	34.1	304	49.8	98	16.1
Evaluation	199	32.6	312	51.2	99	16.2
Content	76	12.5	408	66.8	126	20.7
Pedagogical Content Knowledge	75	12.3	424	69.5	111	18.2

It is inferred from the above table, 12.3% of mathematics group B.Ed. trainees have low, 69.5% of them have moderate and 18.2% of them have high level of pedagogical content knowledge.

TABLE 2

DIFFERENCE BETWEEN MALE AND FEMALE MATHEMATICS GROUP B.Ed. TRAINEES IN THEIR PEDAGOGICAL CONTENT KNOWLEDGE

Pedagogical Content Knowledge and its Dimensions	Male (N =114)		Female (N =496)		Calculated 't' value	Remarks
	Mean	S.D	Mean	S.D		
Philosophy and Sociology	47.22	8.910	50.63	10.140	3.587	S
Curriculum and Instruction	48.95	9.371	50.26	10.131	1.333	NS
Methodology	47.69	8.662	50.56	10.215	3.071	S
Techniques	48.06	7.483	50.46	10.450	2.851	S
Communication	48.55	8.586	50.35	10.276	1.943	NS
Technology	47.46	7.911	50.61	10.340	3.599	S
Psychology	49.26	9.908	50.18	10.021	0.894	NS
Evaluation	48.88	9.420	50.26	10.124	1.391	NS
Content	47.88	7.916	50.49	10.366	2.980	S
Pedagogical Content Knowledge	47.26	8.138	50.63	10.285	3.788	S

(At 5% level of significance, the table value of't' is 1.96)

It is inferred from the above table that there is no significant difference between male and female mathematics group B.Ed. trainees in their knowledge on curriculum and instruction, communication, psychology and evaluation. But there is significant difference between male and female mathematics group B.Ed. trainees in their knowledge on philosophy and sociology, methodology, techniques, technology, content and pedagogical content knowledge. While comparing the mean values of male and female, the female mathematics group B.Ed. trainees are better in their knowledge on philosophy and sociology, methodology, techniques, technology, content and pedagogical content knowledge.

TABLE 3

DIFFERENCE BETWEEN RURAL AND URBAN MATHEMATICS GROUP B.Ed. TRAINEES IN THEIR PEDAGOGICAL CONTENT KNOWLEDGE

Pedagogical Content Knowledge and its Dimensions	Rural (N =382)		Urban (N =228)		Calculated 't' value	Remarks
	Mean	S.D	Mean	S.D		
Philosophy and Sociology	49.62	10.221	50.62	9.618	1.214	NS
Curriculum and Instruction	49.65	10.015	50.64	9.965	1.181	NS
Methodology	49.51	9.818	50.88	10.260	1.616	NS
Techniques	49.80	9.861	50.38	10.246	0.693	NS
Communication	49.65	9.363	50.64	10.980	1.138	NS
Technology	49.66	9.775	50.62	10.362	1.137	NS
Psychology	49.45	9.615	50.94	10.565	1.742	NS
Evaluation	49.58	9.606	50.70	10.621	1.306	NS
Content	49.73	10.240	50.45	9.589	0.869	NS
Pedagogical Content Knowledge	49.47	9.831	50.89	10.237	1.686	NS

(At 5% level of significance, the table value of't' is 1.96)

It is inferred from the above table that there is no significant difference between rural and urban mathematics group B.Ed. trainees in their knowledge on philosophy and sociology, curriculum and instruction, methodology, techniques, communication, technology, psychology, evaluation, content and pedagogical content knowledge.

TABLE 3

DIFFERENCE BETWEEN MATHEMATICS GROUP B.Ed. TRAINEES FROM AIDED AND SELF-FINANCED COLLEGES OF EDUCATION IN THEIR PEDAGOGICAL CONTENT KNOWLEDGE

Pedagogical Content Knowledge and its Dimensions	Aided (N =148)		Self-financed (N =462)		Calculated 't' value	Remarks
	Mean	S.D	Mean	S.D		
Philosophy and Sociology	49.02	10.226	50.31	9.922	1.346	NS
Curriculum and Instruction	51.28	9.153	49.61	10.232	1.876	NS
Methodology	50.72	10.425	49.80	9.860	0.948	NS
Techniques	51.42	10.308	49.57	9.871	1.923	NS
Communication	52.54	11.666	49.21	9.274	3.169	S
Technology	51.70	10.912	49.48	9.642	2.211	S
Psychology	52.78	12.082	49.12	9.069	3.397	S

Evaluation	52.47	11.115	49.21	9.498	3.213	S
Content	51.86	9.906	49.40	9.967	2.617	S
Pedagogical Content Knowledge	52.33	11.489	49.26	9.366	2.958	S

(At 5% level of significance, the table value of 't' is 1.96)

It is inferred from the above table that there is no significant difference between mathematics group B.Ed. trainees from aided and self-financed colleges of education in their knowledge on philosophy and sociology, curriculum and instruction, methodology and techniques. But there is significant difference between mathematics group B.Ed. trainees from aided and self-financed colleges of education in their knowledge on communication, technology, psychology, evaluation, content and pedagogical content knowledge. While comparing the mean values of mathematics group B.Ed. trainees from aided and self-financed colleges of education, the aided college mathematics group B.Ed. trainees are better in their knowledge on communication, technology, psychology, evaluation, content and pedagogical content knowledge.

TABLE 4

DIFFERENCE AMONG MATHEMATICS GROUP B.Ed. TRAINEES FROM MEN'S, WOMEN'S AND CO-EDUCATION COLLEGES OF EDUCATION IN THEIR PEDAGOGICAL CONTENT KNOWLEDGE

Pedagogical Content Knowledge and its Dimensions	Source of Variation	SS	MS	'F' Value	Remarks
Philosophy and Sociology	Between Groups	1550.786	775.393	7.925	S
	Within Groups	59391.315	97.844		
Curriculum and Instruction	Between Groups	995.931	497.966	5.047	S
	Within Groups	59894.020	98.672		
Methodology	Between Groups	2168.246	1084.123	11.207	S
	Within Groups	58720.956	96.740		
Techniques	Between Groups	1719.439	859.720	8.815	S
	Within Groups	59202.975	97.534		
Communication	Between Groups	857.345	428.672	4.333	S
	Within Groups	60046.181	98.923		
Technology	Between Groups	2202.410	1101.205	11.386	S
	Within Groups	58708.811	96.720		
Psychology	Between Groups	166.042	83.021	0.830	NS
	Within Groups	60713.618	100.022		
Evaluation	Between Groups	365.034	182.517	1.829	NS
	Within Groups	60573.982	99.792		
Content	Between Groups	1375.431	687.716	7.013	S
	Within Groups	59523.502	98.062		
Pedagogical Content Knowledge	Between Groups	2439.442	1219.721	12.664	S
	Within Groups	58462.366	96.314		

(At 5% level of significance, for (2,607) df, the table value of 'F' is 3.000)

It is inferred from the above table that there is no significant difference among mathematics group B.Ed. trainees from men's, women's and co-education colleges of education in their knowledge on psychology and evaluation. But there is significant difference among mathematics group B.Ed. trainees from men's, women's and co-education colleges of education in their knowledge on philosophy and sociology, curriculum and instruction, methodology, techniques, communication, technology, content and pedagogical content knowledge. While comparing the mean values of mathematics group B.Ed. trainees from men's, women's and co-education colleges of education, the women's college mathematics group B.Ed. trainees are better in their knowledge on philosophy and sociology, curriculum and instruction, methodology, techniques, communication, technology, content and pedagogical content knowledge.

FINDINGS

1. 12.3% of mathematics group B.Ed. trainees have low, 69.5% of them have moderate and 18.2% of them have high level of pedagogical content knowledge.
2. There is no significant difference between male and female mathematics group B.Ed. trainees in their knowledge on curriculum and instruction, communication, psychology and evaluation. But there is significant difference between male and female mathematics group B.Ed. trainees in their knowledge on philosophy and sociology, methodology, techniques, technology, content and pedagogical content knowledge.
3. There is no significant difference between rural and urban mathematics group B.Ed. trainees in their knowledge on philosophy and sociology, curriculum and instruction, methodology, techniques, communication, technology, psychology, evaluation, content and pedagogical content knowledge.
4. There is no significant difference between mathematics group B.Ed. trainees from aided and self-financed colleges of education in their knowledge on philosophy and sociology, curriculum and instruction, methodology and techniques. But there is significant difference between mathematics group B.Ed. trainees from aided and self-financed colleges of education in their knowledge on communication, technology, psychology, evaluation, content and pedagogical content knowledge.
5. There is no significant difference among mathematics group B.Ed. trainees from men's, women's and co-education colleges of education in their knowledge on psychology and evaluation. But there is significant difference among mathematics group B.Ed. trainees from men's, women's and co-education colleges of education in their knowledge on philosophy

and sociology, curriculum and instruction, methodology, techniques, communication, technology, content and pedagogical content knowledge.

CONCLUSION

The female mathematics group B.Ed trainees are better than male in their knowledge of philosophy and sociology, methodology, techniques, technology, content and pedagogical content knowledge. This may be due to the fact that the female mathematics group B.Ed trainees are generous, caring and they are more democratic than the male in the classroom. They are interested in preparing teaching aids for the class. Also they have better content knowledge than the males which may enrich their confidence level. Thus their pedagogical content knowledge is better than male mathematics group B.Ed trainees.

The aided college mathematics group B.Ed trainees are better than self-financed college mathematics B.Ed. trainees in their knowledge on communication, technology, psychology, evaluation, content and pedagogical content knowledge. This may be due to the fact that the aided colleges have rich experience and permanent staff members. Also the aided colleges are funded by the government which is properly utilized by the colleges for the well being of the students. It influences directly the pedagogical content knowledge of the mathematics group B.Ed trainees.

The women's college mathematics group B.Ed trainees are better than boys' and co-education college mathematics group B.Ed knowledge on philosophy and sociology, curriculum and instruction, methodology, techniques, communication, technology, content and pedagogical content knowledge. This may be due to the fact that the trainees from women's colleges are interested in their profession, have concern for their students and prepare different teaching aids sincerely to the class. And also they are soft in nature and democratic in dealing with the students. So they may be strong in the above mentioned dimensions.

SUGGESTIONS

1. The mathematics B.Ed. trainees have to develop pedagogical reasoning which includes planning, judgements and responses in the classroom.
2. In the mathematics pedagogical paper (Optional–I), the techno-pedagogical components may be incorporated.
3. Pedagogical modules and strategies can be adopted in the mathematics education.
4. Hi-tech mathematics classroom may be established in teacher education institutions, so that the trainee teachers can update themselves.

5. Refresher courses on content knowledge must be organized to the students at the beginning of the course.

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