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Research Article

Relative Effectiveness of Integrated and Conventional Approaches in Developing Teaching Competence

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ABSTRACT

Teachers' content and pedagogical competence, their own views on teaching as an integrated professional activity and confidence in their own teaching abilities eventually determine their classroom practices and quality of students' learning. The pre-service teacher education must attend to professional preparation of teachers. The review of developmental works in microteaching reveals that learning in microteaching also takes place in the cognitive and affective dimensions of the teaching ability besides its performance skill dimension. The integrated approach is conceptualised based on the premise that development of teacher competence needs to take account of training in the performance skill dimension and education in the cognitive and affective dimensions of the teaching ability. This article reports a study comparing the effectiveness of integrated and conventional approaches on teaching competence and self-concept as teacher of student teachers of one-year and four-year teacher education programmes. The Integrated Approach was superior to the Conventional Approach in developing teaching competence of student teachers in science and mathematics, and self-concept as a teacher. The approaches were equally effective for developing teaching competence and self-concept as a teacher among student teachers of one-year and four-year models, but they had differential effect in developing competence in certain teaching abilities among student teachers of science and mathematics.

Keywords: Learning in microteaching, integrated approach, teaching ability, teaching competence.

Introduction

The challenge in the professional preparation of teachers is to help teachers construct their own views on teaching as an integrated professional activity, develop content and pedagogical competence as well as confidence in their own teaching abilities and form their own self as teacher. For, it is a combination of these factors, which would eventually determine their classroom practices and quality of students' learning. Teacher's knowledge of content and pedagogy translates into practice through the filter of their beliefs (Cooney, 1994). Teacher education must attend to the content preparation of teachers within the course structure or address content enrichment while attending to future teachers' pedagogical content knowledge growth in their professional education courses. Teacher education must equip teachers with strategies and skills that would empower them to function productively and successfully within their school settings.

In pre-service teacher education programmes, the courses, which have direct relevance for developing teaching competence, are the content-cum-methodology and microteaching. The methodology course is primarily concerned with ways of interacting with the content of instruction and microteaching deals with teaching skills, which facilitate the process of interaction between the teacher and students. While the content-cum-methodology courses are compulsory, the microteaching is offered as a separate course or a component of content-cum-methodology or some other course. When these courses are offered separately, they are studied concurrently.

Microteaching and Methodology of Teaching Programmes in India

There is now plenty of evidence to show that microteaching has been a valuable addition to repertoire of methods used in education and training of teachers. But the fact remains that microteaching has not really been incorporated into the teacher education programme in many of the Indian universities. In some universities, microteaching programme deals with the nature of a few teaching skills in a very general way without any emphasis on planning, practice and feedback to enable student teachers to recognize and discriminate teaching skills and integrate them into the total lesson. Transaction of Microteaching Course in some other universities contains weekly lectures dealing with the nature of teaching skills,

planning a microlesson by the trainee on a teaching skill in one of his/her subjects of teaching, teaching the lesson to a group of peers (5–10) and receiving feedback from the supervisor and peers. However, replan, reteach and feedback on retaught lesson are not generally followed. This kind of training, in individual teaching skills, results in concentrating on particular aspects of teacher's performance, undervaluing the purpose of teaching, which is to facilitate learning.

The existing methodology courses lay more emphasis on the nature of methods and techniques of teaching at a high level of abstraction that their application to particular type of subject matter is left almost entirely to the ingenuity of the student teacher. The textbooks on methodology courses written usually according to the prescribed syllabi deal with the subject in a very general way without adequate reference to classroom practices as well as the pedagogical issues arising from the nature of the discipline and the learner. As a result student teachers invariably depend heavily on the subject textbooks in planning and implementation of their lessons. A careful analysis of lessons reveals no insight into dimensional behaviours in teaching, which are useful to control the subject-matter of instruction and facilitate pupils' learning (Dorasami, 1986).

It is also apparent from the analysis of macro-lessons, which are intended to teach specific items of subject-matter in real classroom situations, that the type and extent of teaching skills acquired through microteaching programme are rarely incorporated into the macrolessons both at the planning and implementation phases of teaching. Further, under the existing practices in methodology of teaching and microteaching combine; it is hard to believe that students develop decision-making ability, which is considered as the most important teaching skill to which all other skills are related.

The implication of the existing situation is that pre-service teacher education should develop the teacher's competence in strategies of teaching different kinds of subject matter and skills dealing with the process of interaction between teacher and pupils.

Integrated Approach for Developing Teaching Competence - Theoretical Framework

Strategies of Teaching the Kinds of Subject Matter

Teaching strategies are considered as skilful plans that control the subject matter of instruction and direct student behaviour towards selected learning outcomes. Smith et al (1967), in an attempt to describe teaching, classified verbal interaction into eight types of ventures-casual, conceptual, evaluative, particular, interpretative, procedural, reason and rule and further identified broad categories of 'moves' and summarized the most common strategy or pattern of moves for each venture. Cooney, Davis and Henderson (1975) suggested that moves in teaching concepts, generalizations, skills in mathematics and ways of generating out of these moves, strategies that are consistent with the nature of the learner, nature and importance of subject matter and instructional time. It has been opined that an understanding of the moves and strategies provides a basis for generating objectives of teaching a kind of knowledge and designing flexible teaching strategies including evaluation and remedial strategies. Further, from the perspective of teacher preparation, teaching can be observed, analyzed, interpreted, described and evaluated besides providing feedback on a lesson using the moves.

Developmental work in microteaching

There is an extensive literature which documents the various practices used in microteaching, research done on microteaching and its associated components of modeling, practice and feedback. The literature shows that microteaching has been a valuable addition to the repertoire of methods used in teacher education programmes throughout the world. The way microteaching is being adopted and research done on microteaching are predominantly based on the behaviour modification approach, which had been criticized for a number of valid reasons. In response to these criticisms, distinctive practices and rationale for microteaching have developed. A brief review of developmental work in microteaching is presented in this section.

In the Component Skills Approach to microteaching introduced by Turney et al. (1973b, 1975, 1976a, 1976b, 1977) at Sydney University, component skills were justified on the basis of both needs and research findings. Understanding the research and theory concerning the skills and recognizing and discriminating the skills were given importance in the Sydney programme. Progressive integration of skills as opposed to training in specific skills was emphasized, necessitating in the progressive increase in lesson time and size of micro class, to facilitate the transition from microteaching to classroom experience. However, this approach had not provided a solution to the problem of establishing strategies of teaching out of a list of teaching skills (Brushing, 1974).

Guelcher, Jackson and Nicheles (1970) and Pereira and Guelcher (1970) developed Dynamic Skills Approach to give teacher experience in deciding the appropriateness, level and combination of skills relevant in a lesson. Lesson Planning was emphasized, as subject matter provides the context for practicing skills so that 'the nature of skills could be understood as the dynamics of the lesson on the basis of their contribution to implementing the logical structure of the lesson and not as distinct behaviours'.

The Social Skills Approach (Morrison and McIntyre, 1972) viewed teaching as a socially skilled activity dependent upon good interpersonal relationships and communication between the teacher and the learner. The microtraining approach developed by Hargie, Saunders and Dickson (1981)and Hargie and Saunders (1983 b),to improve communicative ability, emphasized on identification of relevant skills to be practiced, skill analysis, skill discrimination, skill practice and focused feedback as they viewed that 'a considerable part of the learning in microteaching as cognitive in nature'.

Decision-making ability as the most important teaching skill to which all other teaching skills are related (Shavelson, 1973) formed the rationale for Cognitive Structures Model of microteaching developed by McIntyre, MacLeod and Griffiths (1977). McIntyre argued that the emphasis in microteaching should be on 'conceptualization of teaching skills as normative not in relation to specific behaviours but in relation to cognitive processes'. In this approach the focus was on description and analysis of the teaching using observation schedules rather than on evaluation. Cognitive interpretation of microteaching is meant to bring change in the students' cognitive structures

about teaching, which to a large extent control their teaching behaviour and developing their own self-concept as teacher.

The review of microteaching approaches reveals that learning in microteaching also takes place in the cognitive and affective dimensions of the teaching ability besides its performance skill dimension. McGarvey et al. (1986, p.156) provided a summary of the potential learning in microteaching situation/ activities leading to learning in all the dimensions of a teaching ability and tools for their assessment. Therefore any instructional strategy intended to develop teacher competence needs to take account of training in the performance skill dimension and education in the cognitive and affective dimensions of the teaching ability.

Considering the dynamic nature of teaching and the role of strategies and skills of teaching, an integrated approach has been proposed for providing education and training in skills and strategies of teaching as an alternative to methods and microteaching practices in teacher education programmes, henceforth referred to as conventional approach. The integrated approach, besides emphasizing on the integration of teaching skills into strategies of teaching different kinds of subject matter, is based on the cognitive learning theory that explains which teaching ability/move to use and when to use it resulting in the development of decision making ability and behaviour modification theory that suggests how to act. Further the approach is also conceptualized in terms of the suggested inputs for each of the learning gains – cognitive processes, affective learning and performance skill of teaching skills and strategies.

A study by Autoniou, Kyriakides and Creemers (2011) compared the impact of the DIA and the Holistic-Reflective Approach (HA) to teacher professional development. Teaching skills and teacher perceptions of teaching of 130 teachers and the achievement of their students (n=2356) were measured at the beginning and at the end of the intervention. Group randomisation was employed to compare the impact of the DIA and HA approaches. The results showed that teachers using DIA managed to improve their teaching skills more than teachers employing the HA. The DIA approach used by teachers showed a significant impact on student achievement gains in mathematics. Teacher perceptions and attitudes towards teaching have not been modified due to their participation in the interventions.

Another study titled 'Effect of Microteaching Technique on Teacher Candidates' Beliefs regarding Mathematics Teaching' (Kadir Bilen (2015) investigated the effect of microteaching technique on teacher candidates' beliefs regarding teaching mathematics and on their views regarding classroom instruction. The study employed single group pretest-posttest method and examined the effects of microteaching technique on teacher candidates' belief regarding mathematics teaching efficacy and their perceptions about presenting a lesson in the class. The results of the study showed that microteaching technique positively affects teacher candidates' beliefs regarding mathematics teaching efficacy. This finding of the study is parallel to the results of many other studies in the field conducted by Cackiroglu (2000), Cone (2009), Huinker & Madison (1997), Liang & Richardson (2009),Moseley and Utlay (2006) and Swars and Dooley (2010).

Research Questions and Hypotheses

The primary question of this study was whether a theoretically sound integrated approach would prepare student teachers of greater competence than would a conventional approach. The variables for the comparative analysis were teaching competence and self-concept as teacher.

Hypothesis-1:

Integrated approach (IA) based student teachers will be superior to conventional approach (CA) based student teachers in teaching competence and self-concept as teacher.

It was hypothesized that IA based student teachers would score higher than their CA based counter parts on teaching competence and self-concept as teacher. The rationale for the hypothesized superiority was related to the sound theoretical as well as research bases of relevant inputs provided for gains in cognitive, affective and performance dimensions of learning skills and strategies of teaching.

There are two models of teacher education for preparing teachers for secondary stage of school education to teach different school subjects. The one-year (B.Ed) model is to prepare teachers to teach two subjects in the school curriculum. The minimum qualification prescribed for admission is graduation majoring in atleast one school subject, though postgraduates also take admission in this programme. In this programme the main focus is on the professional preparation through education courses. The four-year integrated B.Sc.Ed model is to prepare teachers to teach two science subjects including Mathematics. The minimum qualification prescribed for admission is a pass in senior secondary with science stream. Content and pedagogical preparation of teachers is taken care of concurrently. Though there are structural variations between these programmes, the amount of instructional time/credit-hours earmarked courses meant to develop teacher competence is almost equal. The study therefore addressed the question whether the two approaches would have differential effect on teaching competence and self-concept (as teacher) of student teachers of one-year and four-year models of teacher education.

Hypothesis-2:

Student teachers of one-year and those of four-year models of teacher education prepared following each of the approaches will be equal in their teaching competence and self-concept as teacher.

It was hypothesized that student teachers of one-year and four-year models of teacher education would score equally well on teaching competence and self-concept as teacher regardless of the approach followed. The hypothesis was based on the rationale that though there were structural variations between these programmes, the amount of instructional time/credit-hours earmarked for courses meant to develop teacher competence and quality of instructional inputs being equal; learning of equivalent groups will be equal.

The study also addressed the question whether the two approaches would have differential effect on teaching competence and self-concept (as teacher) of student teachers of science and mathematics.

Hypothesis-3:

Student teachers of science and those of mathematics following each of the approaches will be equal in their teaching competence and self-concept as teacher.

It was hypothesized that student teachers of science and mathematics would score equally well on teaching competence and self-concept as teacher regardless of the approach followed. The nature of a subject is one of the factors that determine teacher's approach to teaching of it. Science and mathematics are to be taught differently as the nature of the subjects differs. The strategies of teaching different kinds subject matter are different. However the 'what' and 'when' of different moves, strategies and skills are the same, though there are differences in both the range and the ways of using them. A teacher can be competent in the moves, strategies and skills when these are learnt in the context in which they are to be used. Therefore is the hypothesis.

Participants

The subjects in this study were student teachers of one-year model of teacher education (B.Ed.) and four-year integrated model of teacher education (B.Sc.Ed.). The B.Ed. group consisted of 39 and 38 student teachers offering methodology of teaching biology and mathematics, while their counter parts in the B.Sc.Ed were 25 and 24 respectively.

Design

A 2x2x2 randomized factorial design with unequal replication in each of the eight groups was employed. Student teachers in each model of teacher education and in each subject of teaching were formed into two equivalent groups on the basis of non-verbal intelligence measured using Raven's Standard Progressive Matrices and content knowledge in the respective subject. Then the two equivalent groups were randomly assigned to the conventional approach (the control group) and integrated approach (the experimental group). The equivalence of two groups in each of the four combinations of model of teaching and teaching subject was statistically established. The design with subject allocation is given in the table below:

Table-1. Model of Teacher Education

Approach	One-year B.ED		Four-year B.Sc.Ed	
	Science	Maths	Science	Maths
Integrated	19	20	14	13
Conventional	20	18	12	13
Total	39	38	26	26

Treatment

The four groups under one-year model received instruction for 18 weeks including five weeks of internship in teaching during the first semester. Each group received instruction for seven hours a week in pedagogy. The groups were exposed to core skills of programme intended to develop teaching skills and general principles of evaluation for five hours a week. The classes for the experimental and control groups in each were conducted concurrently. Internship in teaching was organized at the end of the first semester.

The four groups under the four-year model received instruction for 18 weeks during the first semester and 16 weeks in the second semester of the third year of their programme. Each group received instruction for four hours a week in pedagogy and teaching skills. Internship in teaching was organized at the end of the first semester in the fourth year. A brief description of the components of the IA and CA is presented in the following paragraphs.

Control Groups

The four control groups, two each in science and mathematics, were exposed to various methods of teaching through lecture-cum-discussion, emphasizing the nature and scope of each method to teach the respective subject of specialization and standard microteaching for acquiring teaching skills by a team of experienced faculty members in the respective disciplines. The importance of observation of teaching (both micro- and macro-lessons) and use of rating scales (Jangira et.al., 1982) were discussed. Modeling was provided through demonstration of each method as well as skills in a simulated condition. Student teachers then prepared microlesson plans for each skill identifying the component skills of it, practiced in simulated conditions with peers as pupils and received feedback from supervisors and peers using rating scales. After practicing each of the skills, opportunity was provided to plan and practice integration of skills by summative strategy. This was followed by planning macrolessons to teach a given subject–matter, implementing the plan in a real classroom situation and receiving feedback from supervisors and peers.

Experimental Groups

Student teachers of the four experimental groups were exposed to the moves and strategies of teaching the process and the product of their respective subject. The nature of teaching skills - introduction, questioning, closure, reinforcement, stimulus variation, classroom management, etc. and their component skills were explained on the basis of their contribution to implementing the logical structure of the lesson by the investigators. This was done in order to give experience in deciding the relevance, level and combination of the particular skills deemed applicable in a particular teaching situation. Lesson planning was emphasized to recognize the subject matter as the context for practicing the anticipated skills so that the skills can be viewed as subsystems and not as isolated behaviours.

Symbolic (written) models and demonstrations in simulated and real classroom situations were provided to help trainees to develop an understanding of the teaching process through conceptualization of not only how to use strategies and skills but also when to use them. The models are also meant to highlight that the subject matter is a context in which the appropriate strategies and skills would be identified, integrated and practiced. Such an emphasis would provide a solution to the problem of establishing strategies of teaching out of a list of teaching skills and of recognizing that skills are not isolated parts of behaviour but interact with one another. Integrating teaching skills into the strategies of teaching a subject matter would also provide experiences in developing decision-making ability.

Table-1: Comparison of Instructional Approaches

Components of Approach	Approach	
	Integrated	**Conventional**
1. Theoretical base		
a. Methods/ Strategies of Teaching	Emphasis on content categories and moves and strategies of teaching concepts, generalizations, skills and problem solving	Emphasis on nature, merits and demerits of the methods of teaching
b. Teaching skills	Discussions on the nature of the skills as "the dynamics of the lesson" in which supervision of microteaching and use of observation schedules to identifying those dynamic elements of lesson that seemed to account for its success or failure and applying these elements to evaluate the behaviours .Teaching skills were explained on the basis of their contribution to implementing the logical structure of the lesson.	Discussions on the nature of the skills and supervision of microteaching and use of rating scales to provide feedback.
2. Understanding Strategies and skills in action	Identifying the skills and their component skills and moves used in a lesson plan based on a strategy for teaching a particular kind of subject-matter and evaluating their relevance and adequacy to facilitate learning. Identifying the moves and skills-in-action in a transcript of a lesson and analyzing critically its behavioural components and evaluating their effectiveness.	
a. Discrimination Training		
b. Modelling	Demonstration of skills-in-action in a macrolessons by supervisors in simulated and real classroom situations.	Demonstration of skills-inaction in microlessons by supervisors in simulated classroom situations.
3. Practice of strategies and skills	Preparing macro lesson plan for teaching a particular kind of subject matter incorporating relevant skills and identifying the skills and in the lesson plan by one or more students.	
a. Planning		Preparing micro-lesson plan for teaching.
b. Practice	Implementing the planned lesson by one or more students to practice one or two major skills and a number of supportive skills keeping in mind the logical development of the subject matter in a simulated situation with peers as students.	Each student practices a skill in a simulated situation with peers as students.
c. Feedback	Peer and supervisor feedback using observation schedules for different skills and transcripts of practiced lesson.	Peer and supervisor feedback using rating scales for teaching Skills.
d. Integration of skills	Planning and teaching a kind of subject matter to practice all the relevant skills in a simulated situation.	Summative strategy.
4.Transfer of strategies and skills		
a. Planning	Preparing macro lesson plan as in the previous stage.	Preparing macro lesson plan without deliberately incorporating skills in the lesson.
b. Practice	Real classroom situation	Real classroom situation
c. Feedback	As in the preceding stage	As in the preceding stage

The importance of observation of teaching (both micro-and macro-lessons), and use of observational schedules for identifying those dynamic elements-moves/ component skills of a lesson that seemed to account for its success or failure were discussed. Student teachers were exposed to discrimination training to help them to learn to identify the skills in action, to analyze critically their behavioural components and to evaluate their effectiveness and thus form their own views on teaching.

Student teachers then prepared macrolessons for teaching different kinds of subject-matter incorporating relevant skills and moves. Initially 2-3 student teachers prepared a lesson plan. Pre-teach discussions with student teachers were held to analyze and identify various moves used in the chosen strategy for teaching an item of knowledge and component skills of various skills to be practiced. The student teachers implemented the planned lesson, each one practicing a major

skill and a number of supportive skills in simulated conditions with peers as pupils and received feedback from supervisors and peers using observation schedules suggested by Brown (1978). This was followed by planning macrolessons to teach a given subject-matter, implementing the plan in a real classroom situation by each student teacher and receiving feedback from supervisors and peers.

Data Collection

The teaching competence scale developed by the investigator was used to assess teaching competence during internship. The scale consists of four components-Lesson Planning, Teaching-Learning Situation, Evaluation and Teacher. Four aspects-Instructional Objectives, Content, Learning Activities and Evaluation-were included under the component of lesson planning. Introduction, Development of lesson, Explaining, Questioning, Use of blackboard, Pupils' participation, Closure of a lesson, and Class management are the eight skills included under the component of Teaching-Learning Situation. The criteria/ teacher behaviour to be considered in assessing ability in lesson planning and use skills in teaching-learning situation were also listed. A rating scale with seven points – 1 (extremely poor), 2 (very poor), 3 (poor), 4 (average), 5 (good), 6 (very good) and 7 (excellent) was provided for assessing each aspect/skill. The inter-rater reliability of single rating, which is approximately equal to the average of inter-correlations between the ratings given by pairs of supervisors, was 0.78 and 0.82 in science and mathematics respectively. The reliability of the mean of four ratings in science and mathematics were 0.93 and 0.95 respectively. Teaching performance on each lesson of forty-five minutes duration in real classroom situation was rated on a 7-point scale ranging from 1 (extremely poor) to 7 (excellent) for each aspect in the teaching competence scale and for each student teacher the mean rating for each aspect of teaching was computed.

The weighted mean, a measure of overall teaching competence of a student teacher, was calculated by giving weightage of 1.5, 1.0, 1.5, 1.0, 1.0, 2.5, 2.0, 2.0, 1.0, 1.5, 1.0, 1.0, 2.0 and 1.0 respectively to different aspects/skills in the scale in the scale in the aforementioned order.

'Self-concept as Teacher' scale developed by the investigator was used to measure student teachers' perception of themselves as teachers. The scale consists of 58 items with 36 positive and 22 negative statements covering motivation and competence dimensions. The statements are to be rated on a five point scale - strongly agree, agree, undecided, disagree and strongly disagree. The test-retest and spilt-half reliability coefficients of the scale were o.77 and 0.92 respectively. The self-concept as teacher scale was administered to student teachers before and after the internship in teaching. After each administration, the response alternatives for positive items were weighed from 5 (strongly agree) to 1 (strongly disagree). The scoring was reversed for response alternatives for negative items. The scores for all items were added to obtain the total score for each student teacher.

Data Analysis

The mean ratings of individual teaching abilities and overall teaching competence were computed and are shown in table-2a.

The results reveal highly contrasting performance on individual teaching abilities and overall teaching competence between and within the treatment groups. The mean scores of each of the IA based groups on all the individual teaching abilities, teacher characteristics and overall teaching competence were greater than those of their CA based counterparts. Further the mean scores of all the IA based groups on each of the teaching abilities, teacher characteristics, and overall teaching competence were greater than mean scores of the CA based groups except in the case of the abilities, bringing closure of a lesson and class management.

All the individual teaching abilities of the IA based B.Ed science group were rated between 'average' and 'good'. Except the teaching ability, Bringing closure of lesson, which was rated between 'poor' and 'average', all other abilities of the IA based B.Ed and B.Sc.Ed mathematics groups were rated between 'average' and 'good'. In case of B.Sc.Ed science group six teaching abilities were rated between 'average' and 'good' and the others were rated between 'poor' and 'average'.

In contrast, all the teaching abilities except use of blackboard and class management of the CA based science group were rated between 'poor' and 'average', while these two teaching abilities were rated slightly above 'average'. For the CA based mathematics group, twelve teaching abilities were rated between 'poor' and 'average' and one (bringing closure of a lesson) was rated between 'very poor' and 'poor'. The CA based B.Sc.Ed groups were rated between 'very poor' and 'average'. While the CA based groups were rated slightly above 'average' on teacher characteristics, the IA based groups were rated between 'average' and 'good'. All the experimental groups were rated between 'average' and 'good', on overall teaching competence, while the control groups were rated between 'poor' and 'average'. Thus the IA based B.Ed science and mathematics and B.Sc.Ed mathematics groups were superior to B.Sc.Ed science group, no group was superior to other groups among CA based groups on all the teaching abilities, teacher characteristics and overall teaching competence.

Self-concept as a Teacher

Student teachers' self-concept as a teacher of different treatment groups was assessed prior to and after the internship in teaching. The mean scores of the groups on both the occasions are presented in table -2b.

The possible minimum and maximum scores on the self-concept scale are 58 and 290 respectively. The mean scores of all the treatment groups revealed that student teachers had positive self-concept of themselves as teacher, which had improved slightly or remained stable of all except B.Ed science and B.Sc.Ed mathematics groups after the internship experience. After internship the mean scores of the IA based groups were higher than the mean scores of their corresponding CA based groups.

Effects of Instructional approach, Model of Teacher Education and Teaching Subject

The main purpose of the present study was to examine the relative effectiveness of instructional approaches and effect of interaction between instructional approach and model of teacher education and teaching subject on student teachers' teaching competence and self-concept as a teacher.

Table-2a: Mean Scores for the 2x2x2 Factorial Experiment on Individual and Overall Teaching

Teaching Competence	Model of Teacher Education			
	B.Ed		B.Sc.Ed	
	Science	Maths	Science	Maths
A. LESSON PLANNING				
1. Stating Instructional Objectives				
IA	4.569	4.864	3.827	4.482
CA	3.556	3.362	2.931	2.682
2. Selection and Organisation of Content				
IA	4.586	5.060	4.038	4.959
CA	3.957	3.598	3.757	3.617
3. Designing Learning Activities				
IA	4.406	4.984	3.694	4.933
CA	3.626	3.534	3.402	3.558
4. Devising Evaluation				
IA	4.225	4.377	3.541	4.204
CA	3.301	3.033	2.992	2.692
B. TEACHING-LEARNING PROCESS				
5. Introducing a Lesson				
IA	4.309	4.371	3.702	4.204
CA	3.58	3.168	3.077	2.605
6. Developing a Lesson				
IA	4.568	4.649	4.101	4.858
CA	3.79	3.478	3.21	3.63
7. Explaining				
IA	4.539	4.829	4.186	4.921
CA	3.927	3.196	3.237	3.143
8. Questioning				
IA	4.264	4.706	3.896	4.686
CA	3.551	3.357	2.918	3.466
9. Using Blackboard				
IA	4.671	4.917	4.266	5.045
CA	4.156	3.957	3.181	4.094
10. Pupils Participation				
IA	4.363	4.713	3.855	4.563
CA	3.74	3.699	2.848	3.832
11. Bringing Closure to a Lesson				
IA	4.254	3.849	3.657	3.425
CA	3.579	2.706	2.699	1.96
12. Class Management				
IA	4.565	4.745	4.347	4.538
CA	4.368	3.854	3.756	3.896
13. Evaluating Pupils' Learning				
IA	4.418	4.388	3.836	4.323
CA	3.737	3.159	2.775	3.054
C.TEACHER				
14. Teacher Characteristics				
IA	5.001	4.888	4.63	4.952
CA	4.449	4.424	4.227	4.399
D. OVERALL TEACHING COMPETENCE				
IA	4.462	4.687	3.956	4.623
CA	3.784	3.453	3.138	3.351

Table-2b: Mean Scores for the 2x2x2 Factorial Experiment on Self-concept as a Teacher

Training Strategy	Model of Teacher Education			
	B.Ed		B.Sc.Ed	
	Science	Mathematics	Science	Mathematics
Prior to Internship				
IA	233.32	232.5	231.50	233.23
CA	220.85	216.22	222.58	239.09
After Internship				
IA	236.11	238.0	232.07	236.38
CA	220.10	226.56	227.67	233.91

Table-3a: Summary of F-ratio for the 2x2x2 Factorial Experiment on Individual and Overall teaching competence

Competence in teaching	Main Effects			Interaction Effects			
	A	M	S	AxM	AxS	MxS	AxMxS
A. LESSON PLANNING							
1. Stating Instructional Objectives	92.6*	20.14*	0.88	0.11	6.61+	0.32	0.59
2. Selection and Organisation of Content	58.15*	2.89	3.39	0.93	15.13*	1.86	0.22
3. Designing Learning Activities	63.53*	3.87	14.80*	1.32	12.84*	3.46	0.71
4. Devising Evaluation	53.54*	5.94+	0.24	0.07	5.72+	0.78	0.97
B.TEACHING-LEARNING PROCESS							
5. Introducing a Lesson	77.76*	15.25*	0.46	0.38	9.41*	0.65	1.13
6. Developing a Lesson	68.69*	1.96	3.72	0.12	2.21	8.23*	0.01
7. Explaining	77.23*	3.15	0.13	0.72	10.68*	3.66	0.12
8. Questioning	68.11*	3.12	9.44*	0.07	2.89	4.47+	0.59
9. Using Blackboard	44.27*	4.46+	10.86*	1.13	0.34	9.69*	1.20
10. Pupils Participation	37.64*	6.64+	13.23*	0.04	0.04	6.32+	1.46
11. Bringing Closure to a Lesson	61.08*	23.81*	17.18*	1.24	3.23	0.32	0.01
12. Class Management	17.11*	3.15	0.00	0.07	1.76	1.41	1.32
13. Evaluating Pupils' Learning	60.04*	9.80*	0.08	0.59	1.91	6.32+	0.38
C. TEACHER							
14. Teacher Characteristics	18.17*	1.43	0.59	0.02	0.12	1.87	0.27
D. OVERALL TEACHING COMPETENCE	83.27*	9.01*	3.11	0.16	5.29+	5.05+	0.05

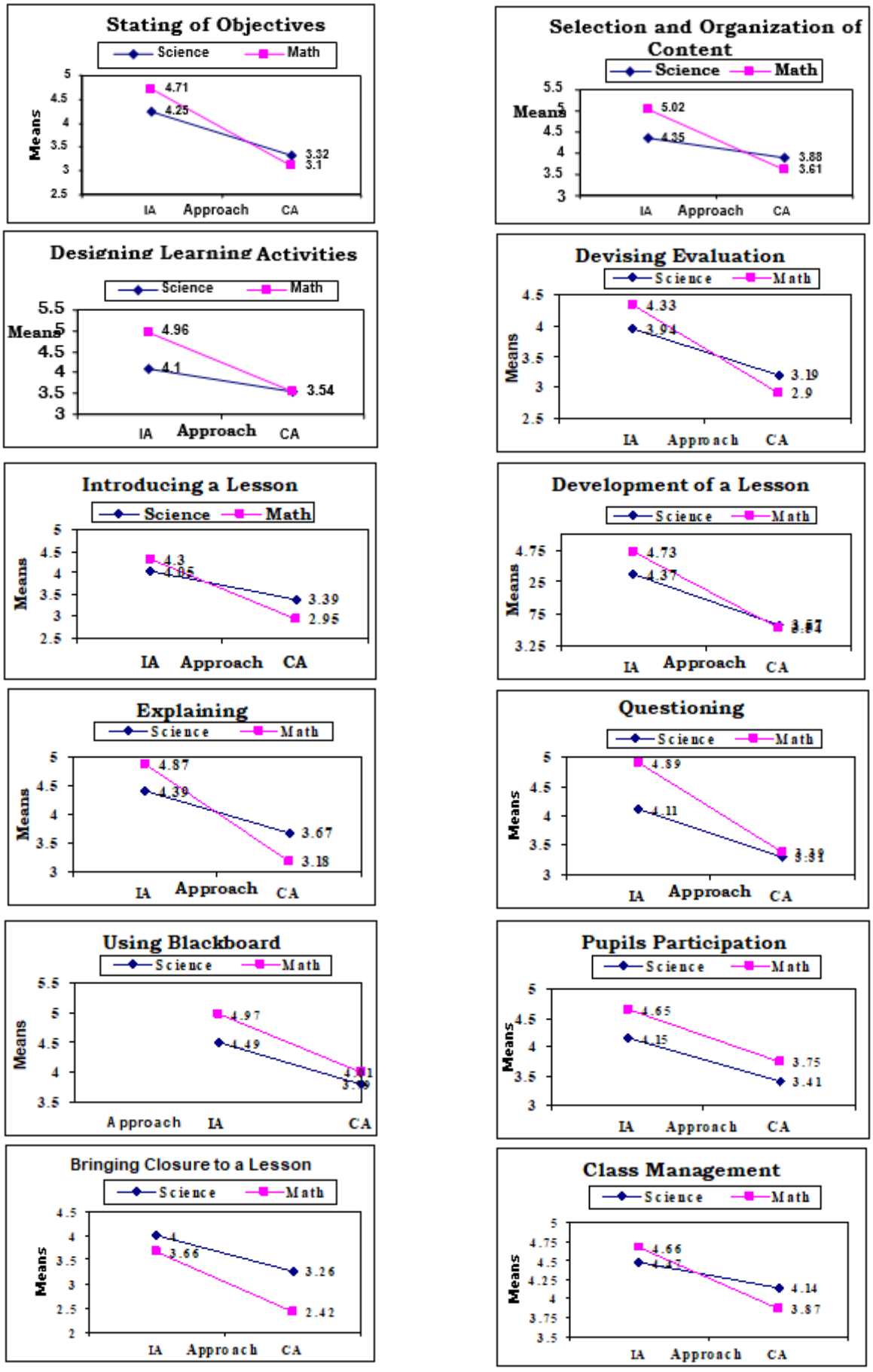
The tabulated values of F are 3.925 & 6.85 at 5% and 1% levels respectively with 1 and 119 degrees of freedom.
* Significant at 5% level and + Significant at 1% level

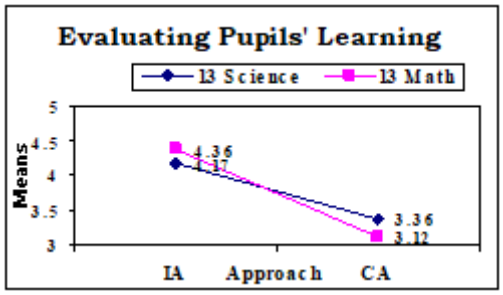
Table-3b: Summary of F-ratio for the 2x2x2 Factorial Experiment on Self-concept as a Teacher

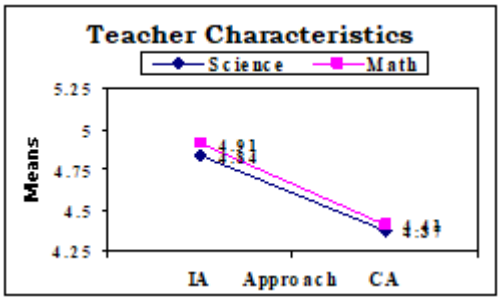
	Main Effects			Interaction Effects			
	A	M	S	AxM	AxS	MxS	AxMxS
Prior to Internship	6.33*	3.46	1.02	4.14*	0.76	3.52	2.16
After Internship	5.82*	0.43	1.77	2.09	0.21	0.02	0.04

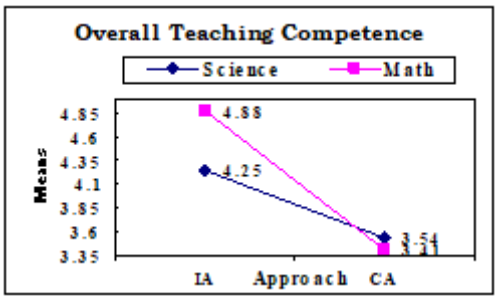
The tabulated values of F are 3.925 & 6.85 at 5% and 1% levels respectively with 1 and 119 degrees of freedom.
Significant at 5% level

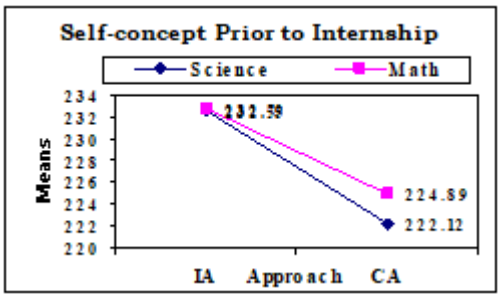
Figure-1. Interaction between Approach and Teaching Subject on Teaching Abilities and Self- Concept as a Teacher

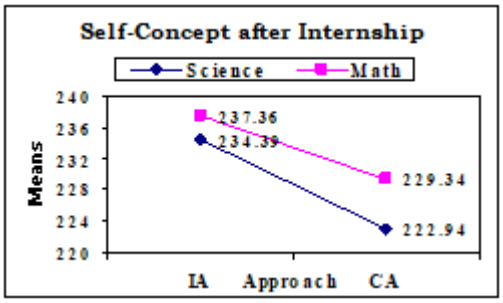












The study employed a 2x2x2 factorial design with unequal number of observations in the treatment groups. Therefore, the scores on each dependent variable were subjected to unweighted means analysis of variance (ANOVA) as detailed in Edwards (1985, pp 237-240). The unweighted means analysis is an exact test of the mean square as all the main effects and interactions have df = 1 only (Speed and Monlezum, 1979). The method of unweighted means applies to the experimental data as the ratio of the largest to the smallest cell frequency is not greater than 2 (Snedecor and Cochran, 1980). The 'homogeneity of variance' of the treatment groups was ascertained using Bartlett's test (Winer, 1962, p.95). The details of the analysis and interpretation of the data are presented in the following paragraphs.

Hypothesis-1: Integrated approach based student teachers will be superior to conventional approach based student teachers in teaching competence and self-concept as teacher.

A scrutiny of data in table-3a reveals that mean scores of the four experimental groups prepared following the integrated approach were higher than those of their CA based counterparts on all the individual abilities and overall teaching competence. The main effect of approach indicates a comparison between the means of groups exposed to the IA and CA averaged over the two levels of model of teacher education and teaching subject. The F-values (df=1,119; p< 0.05) for all the individual teaching abilities and overall teaching competence reveal significant main effect of instructional approach on teaching competence suggesting that the two approaches had differential effect in developing teaching competence with the former being more effective.

The results of ANOVA reveal that the main effect of instructional approach prior to (F=6.33, df=1,119,p< 0.05) and after (F=5.82,df=1,119,p< 0.05) the internship in teaching suggesting that student teachers of IA and CA based groups differed in their self–concept as teacher.

Hypothesis-2: Student teachers of one-year and those of four-year models of teacher education prepared following each of the approaches will be equal in their teaching competence and self-concept as teacher.

The F-values (df=1,119; p< .05) for the interaction effect of training strategy and model of teacher education for all the individual and overall teaching abilities reveal no interaction between training strategy and model of teacher education on all the individual teaching abilities and overall teaching competence. In the case of the teaching abilities – stating instructional objectives, planning for evaluation of learning, introducing a lesson, using of blackboard, increasing pupil's participation, bringing an effective closure to a lesson, and evaluating pupil's learning in a classroom situation and overall teaching competence-though the interaction is not significant, both the main effects are significant. This reveals that approaches differed in their effectiveness in favour of integrated approach and student teachers of one-year

programme performed better than their four-year integrated programme. In the case of the teaching abilities-selection and organization of content, designing learning activities in a lesson, developing a lesson, explaining, asking questions, class management and teacher characteristics-there is a significant main effect for approach, but no significant main effect for model of teacher education. This means that the integrated approach based student teachers performed at a higher level than their counter parts following the conventional approach. It is therefore concluded that the differential effect of training strategies in developing teaching competence of student teachers was independent of the model of teacher education.

Further, the results show one significant interaction between instructional approach and model of teacher education ($F=4.14$, $df=1, 119$, $p< 0.05$) prior to the internship in teaching on self-concept as a teacher. Figure – illustrating this interaction reveals that one-year B.Ed groups prepared following the integrated approach showed greater self-concept (mean=232.59) than their counterparts prepared following the CA (mean = 218.06). This is in contrast with the two treatment groups in the four-year model, which were almost similar in their self-concept. In other words, the IA was equally effective in developing self-concept of student teachers of B.Ed (mean=232.89) as well as B.Sc.Ed (mean=232.33), while CA was more effective for B.Sc.Ed (mean=230.45) than B.Ed (mean=218.06).

Hypothesis-3: Student teachers of science and those of mathematics following each of the approaches will be equal in their teaching competence and self-concept as teacher.

The F-values ($df=1, 119; p<.05$)for the interaction effect of training strategy and teaching subject for the teaching abilities--stating instructional objectives, selection and organization of content, designing learning activities, planning for formative and summative evaluation, introducing a lesson and explaining and overall teaching competence reveal significant interaction between training strategy and teaching subject. The significant interaction together with main effect of only approach reveals that the integrated approach based student teachers in teaching of science as well as those teaching mathematics were superior to their counter parts following the conventional approach in the aforesaid teaching abilities except in designing learning activities. However in the IA based groups the performance of those teaching mathematics was better than those of science, whereas the converse was true for CA based groups. In case of the teaching ability-designing learning activities-the IA based student teachers teaching mathematics performed better than those teaching science, while the CA based student teachers teaching science and those teaching mathematics performed at the level. It is therefore concluded that the effect of training strategy in developing teaching competence of student teachers was dependent upon the teaching subject in so far as the above mentioned teaching abilities.

However, the triple interaction among instructional approach, model of teacher education and teaching subject being not significant indicates that those significant first order interactions between instructional approach and teaching subject were not observed in the one-year and four-year models of teacher education.

Conclusions

The Integrated Approach was superior to the Conventional Approach in developing teaching competence of student teachers in science and mathematics, and self–concept as a teacher. The difference in the effectiveness of the approaches in developing teaching competence and self-concept as a teacher among student teachers were noticed in both the one-year and four-year models. There was a significant interaction between training strategy and teaching subject in their effectiveness in developing competence in stating instructional objectives, selection and organization of content, designing learning activities, planning for formative and summative evaluation, introducing a lesson and explaining, and overall teaching competence. These interactions signify that the integrated approach was more effective in developing competence in these teaching abilities among student teachers of mathematics than those of science. This difference in teaching competence was probably due to significant proportion of student teachers of mathematics mastering the cognitive competencies related to the teaching abilities than their science counterparts (Nirmala, 1992).

The superiority of the integrated approach over the conventional approach could be due to – its sound assumption that teaching skills be viewed as ways of teaching and not as ways of behaving, emphasis on moves and strategies of teaching different kinds of subject-matter rather than on nature of different methods of teaching and using of moves in developing an understanding of cognitive based teaching skills, prominence given to subject-matter in planning and practicing the skills and strategies of teaching, focusing on learning in the cognitive, affective and performance dimensions of the skills and strategies of teaching and providing education in the cognitive and affective dimensions through lectures, modelling, lesson planning, discrimination training, self-confrontation in teaching lessons, sharing of feelings and values in feedback/ review sessions; and training in the performance dimension through practice of skills and strategies in a context relevant for them and feedback. Thus there is a need for adoption of the Integrated Approach in both pre-service and in-service teacher education programmes.

The mean scores of all the four IA based groups on teaching abilities and overall competence were higher compared to CA based groups. The F-test for main effect of instructional approach indicated significant difference by approach in favour of the Integrated Approach. The finding that the mean ratings of even the IA based groups were not higher than 'good' on most of the teaching abilities was a bit surprising. One possible explanation for this finding is that novice teachers require time to internalize and put into practice, and the time actually provided/spent was probably not adequate to attain competence in strategies and skills of teaching. Or that the teacher educators who rated the teaching performance probably failed to identify more frequent use of relevant use of moves and component skills various skills, having conditioned more to the conventional approach.

There is a need for conducting comparative research using larger sample sizes to definitely answer whether teachers prepared through Integrated Approach are indeed superior to those prepared following conventional approach in order to establish the viability of the IA to teacher preparation. In such studies qualitative analysis of the planned as well as the implemented strategies of teaching could be made to assess teaching competence. Future follow-up studies could also do with ascertaining the extent to which IA and CA prepared teachers retain and/or enhance their competence in teaching.

Will the perceived differences in the teaching competence and self-concept of IA and CA prepared teachers continue to widen over the years, or will experience wipe out early differences?

Competing interests

The authors have declared that no competing interests exist.

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