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Development And Standardization Of Constructivist Blended Instructional Paradigm For Teacher Preparation

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Abstract: The purpose of this study was to develop a Constructivist Blended Instructional Paradigm, called as CBIP, for enhancing teaching effectiveness among prospective teachers in teacher preparation and academic performance of learners in schools. The CBIP is a harmonious blend of all pedagogical approaches (behaviorist, cognitivist and constructivist) and technology in a balanced and pragmatic manner. Theoretically, Advanced Curriculum Model of Cognitive Learning (ACMCL) which was developed in National Council for Educational Research and Training, New Delhi and experimented upon in RIEs especially in Mysore and Ajmer guided the integration process in CBIP. Constructivist Blended Instructional Paradigm draws the best from all available resources as per the Indian context & circumstances. In this, knowledge is created situationally, by using contextual support matching with the text book content. In this way, it is a blending of traditionalism and modernism, a harmonious practical combination of East & West. Thus, this paradigm is operationally defined and empirically verified as Constructivist Blended Instructional Paradigm (CBIP). The main emphasis was to develop appropriate blends and define the role of both teacher and learners in the execution of these blends. The CBIP was found to be efficacious as it has improved teaching effectiveness of prospective teachers and academic performance of learners. This model opens plenty of possibilities to solve some of the prevailing problems of Indian Education System.

Key terms: Constructivism, Technology, Blended learning, Instructional paradigm, Teaching effectiveness, Academic performance.

Introduction

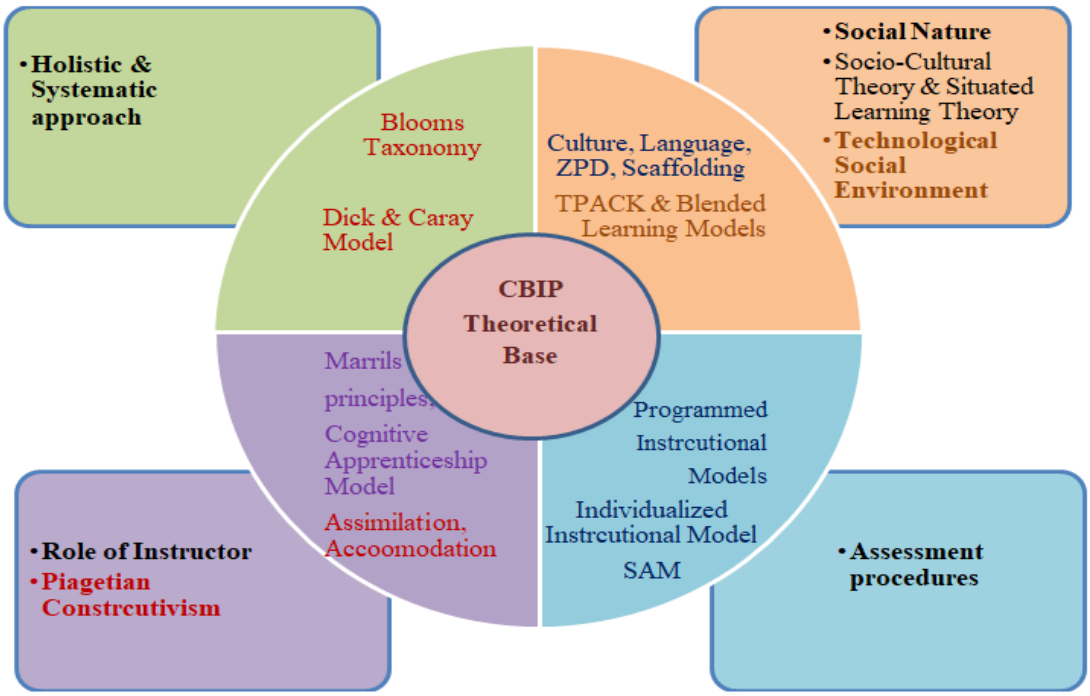
In India, efforts have been made to integrate various approaches of teaching and learning suitable to the unique Indian educational situations. Lunzer (1976) remarked about the rapprochement between Genevan approach (Piaget) & that of new behaviorists (Bloom, Carroll, Gagne & others) for developing a cognitive paradigm (Dave, 1998). However, in India, Dave and Nagpal (1980s) furthered the process of Instructional Design development and efficacy of the rapprochement was established by merging classical teaching paradigms. That time, however, technology was not so popular. At global level, the generic ADDIE model (1975) has influenced the development of subsequent models like Dick & Carey Model, 1978; FutureU ID Model & The Kemp Model, 2004. The researchers improved and improvised ADDIE model with the changing needs of learners and contexts. The technology integration in to generic ADDIE led to the development of new models like ASSURE Model, 1999, Successive Approximation Model, 2011 & TPACK-IDDIRR. At TEIs, the Instructional Designs based on behaviorist approach (Harbertian Model) and constructivist epistemologies (like 5E Model) dominated the instructional procedures. With the emergence

of ICTs, new models like TPACK, ICT-PACK, RCET, ADAPT etc. were developed through integration of ICT in constructivism. Thus, the focus also shifted towards developing the integrated models like Advanced Curriculum Model of Cognitive-Learning (ACMCL), 1976; ARCS Model, 1987; Situational Instructional Design Model (Zemke, 2002); & Ishman-2011 Model, to combine different pedagogical approaches and learning theories with technology. The integration approach in ID development further led to the emergence of blended instructional designs having elements of both traditional face-two-face and online environments like ASSURE Model, ADAPT and ICT-PACK. In the process of ID development, the sociocultural theory, Gagne's instructional events, and Merrill's principles of instruction are still significant in instructional designing systems. The thematic conclusions pointed that efforts have been made in the past to integrate technology but the resultant models were mostly used in distance learning systems or providing instructions at programme or course level. The learners covered some part of programme or course through offline and some part through online systems. It does not correspond to blending at instructional level. The CBIP was supposed to create sequential procedure of instructional experiences to make learning more authentic & efficient.

Development of Constructivist Blended Instructional Paradigm (CBIP)

The development process of paradigm was completed in three stages, Theoretical base & designing of paradigm; Development of lesson plans based on CBIP for the purpose of concretization; and Standardization of CBIP. The theoretical base of the paradigm (Figure 1) was developed after critical analysis of existing instructional models.

Figure: 1
Theoretical Rationale of CBIP



The social nature of model was adapted from socio-cultural theory and situated learning theory; role of previous knowledge, assimilation and accommodation from Piagetian constructivism; holistic approach to instructional design from Blooms models (including revised and digital Blooms taxonomy); technological social environment or technology

integration from TPACK and blended learning models; the importance of culture, language and Zone of Proximal development (ZPD) and scaffolding continuum from socio-cultural theory; the role of instructor from both Cognitive Apprenticeship Model and Merrill principles; systematic planning from Gagne's Nine events and Dick and Carey Model; the assessment features from individualized instructional model, the instructions in small steps from Programme learning and Successive Approximation Model (SAM).

The harmonious blending of various approaches, theories and technology integration led to the emergence of certain principles for the CBIP which were framed in terms of its theoretical rationale are as follow;

1. Knowledge is socially constructed. The world and knowledge co-construct each other.
2. Each learner is basically curious and eager to learn new things through the process of assimilation and accommodation.
3. Learner's environment, culture, language and technology play an important role in the construction of new knowledge.
4. Learner actually learns when confronted with the tasks little higher than their present potential.
5. Teacher is not an information provider but s\he is to be seen as constructor of situations or a facilitator.
6. Technology integration facilitates teaching learning process hence improves academic achievement.
7. The blended pedagogies i.e. best from all worlds, traditional face-to-face and on-line learning environment have potential to improve performance of both; teachers and learners.
8. Systematic planning & contextual execution of instructional procedures supported with effective feedback prepare humane and professional prospective teachers.

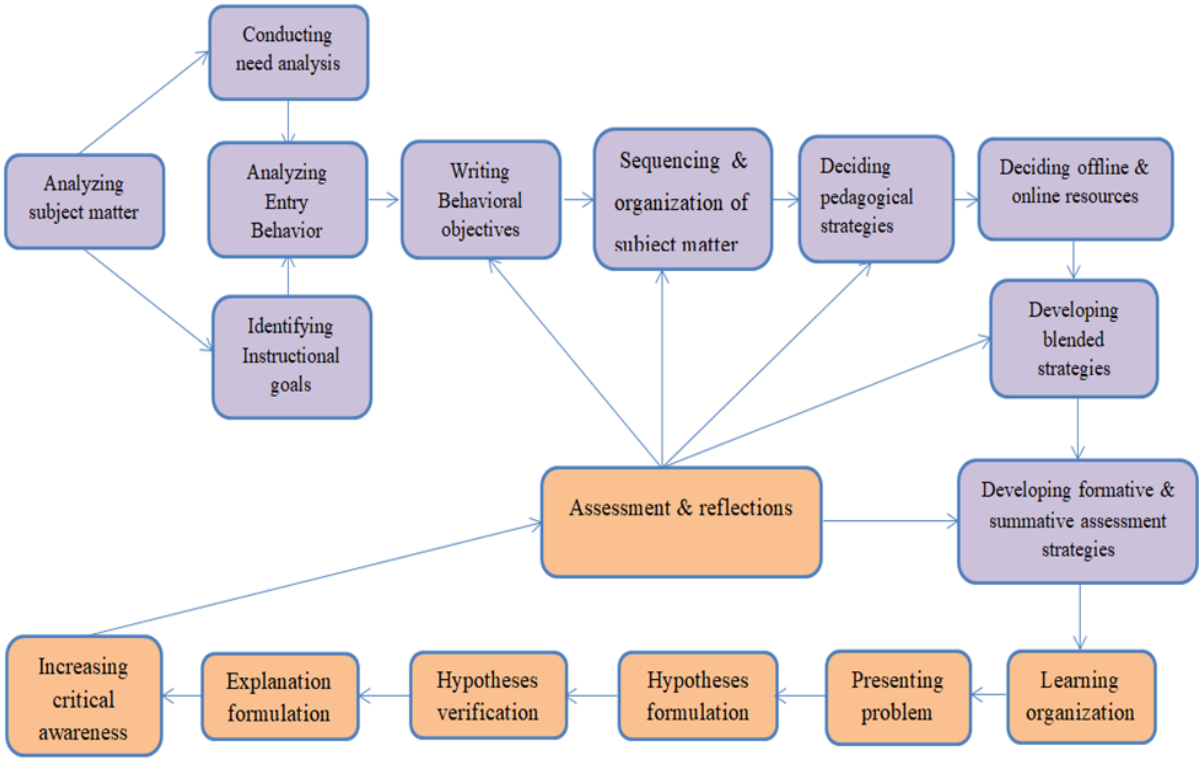
The design of the model was sub divided in to six components (as per Basic teaching model by Glaser, 1962) i.e. focus, syntax, and social system, principle of reaction, support system and application. This division was done to make the paradigm more comprehensive and precise.

The Focus included its goals which were, construction of knowledge; development & use of appropriate blends; preparing professional and humane teachers; developing teaching effectiveness of student teachers; and improving academic achievement of learners

The syntax consisted of Phases and activities in a specific sequence that described the paradigm in action. The syntax of CBIP has three phases i.e. planning phase; implementation phase; and evaluation phase.

The focus of planning phase was on planning of instruction i.e. instructional designing or lesson planning. The outcome of the planning phase was well-developed lesson plans for all the five subjects. The prescribed syllabi, supplementary references and the updated, reliable internet content were used in lesson planning. It included components like goal setting, need analysis, content analysis, entry behaviour of learners, learning environment, expected outcomes as terminal objectives, decision about teaching - learning strategy & nature of blends, deciding learning resources and developing the strategies & blends, designing formative & summative assessment strategies. All these components worked in collaboration with each other, guiding & directing one another. The figure 2 shows the graphical representation of planning and implementation phase of Constructivist Blended Instructional Paradigm (CBIP).

Figure 2
Constructivist Blended Instructional Paradigm (CBIP) for Designing Instruction



Implementation Phase comprised of student-teacher, student-resource, student-student and student-content interactions. The lesson plans based on CBIP were delivered by student teachers in the implementation phase. This phase was sub-divided in to following steps;

1. Learning organization
2. Presentation of the puzzling problem or events
3. Formulation of hypotheses
4. Verification of hypotheses
5. Formulation of explanations
6. Increasing critical awareness
7. Assessment of understanding & reflections

The implementation phase was the phase of actual practice. Both, the teacher and learners played an active role in various steps of implementation phase. The roles of teachers and learners were defined to lessen the gap between theory and practice or to bring reality close to aspirations put forth by CBIP. The roles of teachers and learners were defined to lessen the gap between theory and practice or to bring reality close to aspirations put forth by CBIP. The table1 presents the suggested activities for each step of implementation phase. The activities covered all domains of development and have relevance to the content. In the implementation phase, 90% activities were performed by learners and 10% by the student teachers. The activities involved the blended strategies as power point presentations, animations, videos, wikis, Blog posts, e-news were integrated in the teaching learning process.

Table1
Suggested Activities and Blended Strategies

Step	Suggested activities	Blended strategies

Learning organization	Greetings, Sizing up of the class, Attendance, Organization of resources, Organization of personal learning resources by learners, Informal discussion	Involving learners in checking internet connection and projector, developing blended learning centers in classroom, adjusting sitting arrangement as per technology use and inclusive needs of learners
Presentation of the puzzling problem or events	Presentation of disturbing data, puzzling problem or cases from society; Demonstrations, Activities, Reading, Analyzing graphic organizer & advance organizer	Observations and explorations through offline and online Videos/images/animations, Book content updated with recent information from newspapers
Formulation of hypotheses	Investigation, Brainstorming, Internet surfing, discussion, , generating solutions, Reading books, Asking questions, worksheets	Information search; supplementing book content with updated online content & examples; Reading and posting on Blogs, wikis & discussion forums; working on blended learning stations
Verification of hypothesis	Presentation, reflections and evaluations, experimentation, Argument, debate, persuasion,	Discussions, arguments & debates with offline and online experts; justification with demonstrations and experimentations,
Formulation of explanations	Analysis & explanations by students, Reading & demonstrations, Formal explanations by teachers	Explanations supplemented with online and offline videos and animations of abstract concepts; explanations supplemented with activities and experimentations;
Increasing critical awareness	Presenting societal problems, Experiential inquiry, decision making, problem solving, online collaborations, offline projects;	Discussions on contemporary cases from society with offline and online experts leading to reflective writings; Internet search for extending knowledge to global level.
Assessment of understanding & reflections	Self-assessments, Peer assessments, Offline & online quizzes; rubrics, posts on social media (blog posts, Facebook, twitter, Instagram), Worksheets, Observations, anecdotal records, portfolio, Reflective writings, community projects, redirected and open ended questions, presentations, demonstrations and questions by learners, course seminars and viva voce, online collaborative assignments and creative projects.	Online portfolio for holistic assessments; Offline & online quizzes; posts on social media (blog posts, Facebook, twitter, Instagram) with viva voce, online collaborative assignments and creative projects ending with face to face presentations.

In the implementation phase, the roles of teacher and learners were also defined for each activity/operation. The table 2 highlights the same.

Table 2

Roles of Teachers and Learners

Step	Role of learners	Role of teachers
Learning organization	Organizer, active reception, proactive role	Visionary, manager, organizer, & controller of resources and situations; based on ethical conduct
Presentation of the puzzling problem or events	Observation & reflections on images, animations, videos, wikis, Blog posts, e-news; Assimilation with previous knowledge & Accommodation of new knowledge; Model reading Asking questions	Presenting problematic case, data or event; Creating interest, curiosity and raising questions; Model reading, Structuring problems from immediate environment
Formulation of hypotheses	Investigation, Brainstorming, Surfing on internet, discussion, Collecting information, generating solutions, Reading books, Asking questions, Preparation & completion of worksheets	Observation, supervision and facilitation in hypotheses formulations
Verification of hypotheses	Arguing, debating, testing & defending the hypotheses; Validating, reviewing & reflecting	Facilitating hypotheses verification process through yes/no types of question-answers; Validating correct explorations
Formulation of explanations	Summarizing & paraphrasing; Recording observations, explanations and drawing reasonable conclusions and reflections	Encouraging & facilitating the explanations by learners; Giving technical terminologies and formal explanations
Increasing critical awareness	Working independently and in collaboration with both offline and online community to solve problems; Using critical & creative thinking	Encouraging the learners to apply or extend the concepts and skills in new situations; Challenging the understanding with higher order content; Arranging offline & online expert talks
Assessment of understanding & reflections	Filling self-assessment forms, rubrics & reflective writing worksheets; Summarizing the module & overall lesson; Giving feedback	Assessing communication, presentation, thinking and social skills throughout the process; Asking questions relating to objectives; Creating situations for affective & psychomotor assessments; Giving remedial help, re-teaching & re-evaluating; Home work

The evaluation phase consisted of evaluation of paradigm with reference to its focus which included construction of knowledge, development & use of appropriate blends, preparing professional and humane teachers, developing teaching effectiveness, improving academic achievement in learners. The evaluation can be done with the help of evaluation performa or peer evaluations. In the process, the evaluation of paradigm was done with the help of rating scale on teaching effectiveness for student teachers; perception scale towards teaching for learners; and academic records of students.

Social system deals with the Interactive roles of teachers and students in the learning process. It was controlled or structured in beginning then relaxed leading to open environment. There were proper teacher-student, student- resource and student-student interactions

The principle of reaction deals with the nature of teacher interactions with learners. The student teachers gave specific statements, yes/no answers, encourage collaboration, pointed invalid questions and used previous experiences and ideas of students as source for teaching.

Support system tells about the additional requirements in the teaching learning process. The confronting material or problem, knowledge about construction process, technological resources and computer with installed software and internet connection constituted the support system of CBIP.

The application aspect tells about the potential uses of CBIP. This paradigm can be used in teaching & training, training pre- service teachers, developing teaching competencies, training in-service teachers for technology use in education, and for improving academic achievement of school students.

Standardization of Constructivist Blended Instructional Paradigm (CBIP)

For the purpose of standardization of CBIP, 5 student teachers (one each from Science, English, Hindi, Social Science & Mathematics) having above average level of teaching effectiveness were selected through convenience sampling technique. The 5 student teachers were trained to teach through lesson plans based on CBIP during their teaching internship in 3 secondary schools for 6^{th}, 7^{th} & 9^{th} grades. The students in these classes were already grouped in two sections. The student teachers administered a self-constructed test (pre-test) on the school students in their respective subjects. On the basis of pre test scores, the 166 school students having scores of 60% and above were grouped in two groups i.e. experimental and control group with minimum possible shuffling of students. In experimental group, the student teachers took classes of 83 learners by using CBIP paradigm. Simultaneously, 5 school teachers took classes of control group having 83 learners with same syllabus using traditional method of teaching. The Table 3 depicts the sample distribution of CBIP standardization process.

Table 3

Sample for Standardization Process

S. No.	Subject	Class	Control group	Experimental group
1.	Science	9^{th}	17	17
2.	English	6^{th}	18	18
3.	Hindi	9^{th}	18	18
4	Social Sciences	7^{th}	15	15
5	Mathematics	7^{th}	15	15
Total			83	83

In experimental groups, the student teachers by using CBIP completed 2 chapters from the regular text books of each subject, approximately through 11-12 lesson plans/periods of 35 minutes followed by a unit test as normal formalities of CCE. In between, student teachers' 1^{st}, 6^{th} & 11^{th} lessons too were observed using self-standardized Teaching Effectiveness Scale (TES) in the experimental groups to see the efficacy of CBIP paradigm. In this way, data of pre-post achievement scores of learners in the school classroom and teaching effectiveness scores of student teachers were simultaneously collected. The standardization of CBIP was done in following three ways;

1. The significance of difference between means of consecutive observations of student teachers to explore the impact of CBIP on teaching effectiveness.
2. The performance based standardization where pre–post experimental research design was applied on achievement scores of learners in experimental groups.

3. The matched group post-test research design was used to find out the differences in academic achievements of learners taught through CBIP (experimental group) & through traditional method of teaching (control group).

The details of all the three ways of standardization are as below:

Significance of difference among Means of Consecutive Observations

As stated earlier 1st, 6th& 11th lessons of student teachers of experimental groups were observed with the help of teaching effectiveness scale and were treated as observation-1, 2 and 3 respectively. To test the efficacy of CBIP on the teaching effectiveness of student teachers, paired sample t' test was used on these three observations of the student teachers. The results are presented in table 4.

Table 4

Difference in Mean Observation Scores of Student Teachers

Observation Number	Mean	N	SD	SE_D	t' value	p-value
Observation-1	351.00	5	53.46	16.01	3.71*	0.02
Observation-2	410.40	5	20.96			
Observation-1	351.00	5	53.46	21.32	3.42*	0.02
Observation-3	424.00	5	11.07			
Observation-2	410.40	5	20.96	8.15	1.67	0.17
Observation-3	424.00	5	11.07			

*significant at 0.01 level of significance

The p-value in the table 4 is probability value for a given statistical model. If the p-value is less than 0.05, the null hypothesis of no difference between the means is rejected, leading to infer that a significant difference exists between the two groups. Table 4 reveals the significant difference in teaching effectiveness of student teachers between 1st& 2nd and 1st& 3rd observations. The teaching effectiveness mean from 2nd to 3rd observation has also increased but, however, the increase was not found to be significant. The mean difference between observation 3 (M=424; SD=11.07) and observation 1 (M=351; SD=53.46) was significant at t' (4) = 3.42, p-value=0.02. So, the significant differences were observed in the observations and it was concluded that CBIP has increased the teaching effectiveness of student teachers. Hence, CBIP was effective.

Effect of CBIP on Academic Performance of Learners

The 2ndway of standardization was performance based. The pre-post experimental research design was used on all five experimental groups to explore the impact of CBIP on academic performance of learners. The null hypothesis was formulated as there is no effect of CBIP on academic performance of learners. The paired samples t' tests were calculated for all the five subjects in experimental/treatment groups as given in table 5.

Table 5

Difference between Mean Pre-test and Post-test Scores of learners

Subject	Test	Mean	N	SD	SE_D	t' value	p-value
Science	Pre-test	18.65	17	3.60	0.521	5.54*	0.00
	Post test	21.53	17	3.91			
	Pre test	19.40	15	5	0.330	8.88*	0.00

Maths	Post test	22.33	15	4.94			
English	Pre test	18.00	18	2.61	0.505	2.64*	0.01
	Post test	19.33	18	3.46			
Hindi	Pre test	17.44	18	3	0.571	3.31*	0.00
	Post test	19.33	18	4.23			
Social Science	Pre test	17.93	15	3.53	0.853	2.66*	0.01
	Post test	20.20	15	5.18			
Overall	Pre test	18.25	83	3.56	0.26	8.58*	0.00
	Post test	20.48	83	4.40			

*significant at 0.01 level of significance

Table 5 shows that mean difference between pre-test (M=18.25; SD=3.56) and post-test (M=20.48; SD= 4.40) was significant at t' (82) = 8.58, p-value =0.00. So, the null hypothesis that there is no difference between pre and post achievement scores was rejected. In Science subject, the mean difference between pre-test (M=18.65; SD=3.60) and post-test (M=21.23; SD= 3.91) was significant at t' (16) = 5.54, p-value =0.00. In Mathematics, the mean difference between pre-test (M=19.40; SD= 5) and post-test (M=22.33; SD= 4.94) was significant at t' (14) = 8.884, p-value =0.00. In English subject, the mean difference between pre-test (M=18; SD=2.61) and post-test (M=19.33; SD= 3.46) was significant at t' (17) = 2.64, p-value =0.01. Similarly, in Hindi subject, the mean difference between pre-test (M=17.44; SD=3) and post-test (M=19.33; SD= 4.23) was significant at t' (17) = 3.31, p-value =0.00. In Social Science subject, the mean difference between pre-test (M=17.93; SD=3.53) and post-test (M=20.20; SD= 5.18) was significant at t' (14) = 2.66, p-value =0.00. So, the significant differences were found in pre and post-tests in all the five subjects at 0.01 level of significance. Therefore, it was concluded that the treatment given by CBIP has increased the academic performance of learners in experimental groups. Hence, CBIP was effective.

Matched Group Post-Test Research Design

The third way of standardization process was through the academic performance of learners in two groups i.e. treatment and control. The matched group post-test research design was used to find out the difference between academic performances of learners taught CBIP treatment (experimental group)& traditional method of teaching (control group).The null hypothesis was formulated as there is no significant difference between academic performances among learners of experimental and control group. The t' tests were calculated for all the five subjects and the results are presented in table 6.

Table 6

Difference in Mean Academic Achievement Scores among Learners of Experimental and Control Group

Subject	Group	N	Mean	SD	SE_D	t' value	p-value
Science	Experimental	17	21.53	3.91	1.27	2.46*	0.02
	Control	17	18.41	3.48			
English	Experimental	18	19.33	3.46	1.10	2.68*	0.01
	Control	18	16.39	3.13			
Hindi	Experimental	18	19.33	4.23	1.25	2.39*	0.02
	Control	18	16.33	3.24			
Social Science	Experimental	15	20.20	5.18	1.70	1.76	0.09
	Control	15	17.20	4.07			
Mathematics	Experimental	15	22.33	4.94	1.61	2.40*	0.02
	Control	15	18.47	3.81			

All 5 subjects	Experimental	83	20.48	4.40	0.62	5.09*	0.00
	Control	83	17.31	3.57			

*significant at 0.01 level of significance

Table 6 shows that there was significance difference in mean academic achievement scores among learners of experimental (M = 20.48; SD = 4.40) and control group (M = 17.31; SD = 3.57) for t' (164) = 5.09, p-value=0.00. So, the null hypothesis that there is no significant difference between academic performances among learners of experimental and control group was rejected. The significance difference was also found in mean academic scores among learners of experimental and control group in Sciences, English, Hindi, and Mathematics subjects. However, no significant difference was found in mean academic scores among learners of experimental (M = 20.20; SD = 5.18) and control group (M = 17.20; SD = 4.07) for t' (28) = 1.76, p-value=0.09 in Social Science.

The overall result revealed significant effect of CBIP on academic achievement of learners; hence, paradigm was effective. So, it was concluded that Constructive Blended Instructional paradigm was effective in preparing student teachers as well as in enhancing academic achievement of learners.

Conclusion

The development of Constructivist Blended Instructional Paradigm (CBIP) was a balanced & harmonious blend of different pedagogical approaches, learning theories and technologies. It was blending of traditionalism and modernism, a harmonious practical combination of East & West. The best elements of different theories (Piagetian constructivism, Blooms models, socio-cultural theory, situated learning theory, Cognitive Apprenticeship Model, Merrill principles, Gagne's Nine events, Dick and Carrey Model, and Successive Approximation Model) were integrated with best elements of technology (as per TPACK and blended learning models). This paradigm has vast potential to solve the problems of Indian Education System. It improved the pedagogical richness in prospective teachers, ensured equality in educational opportunities for all learners, improved the academic performance of learners, provided universal access and equality in educational opportunities, and reduced the cost of education thereby, found solution to the problem of high investments and low returns. In this sense this model was of immense importance for educational institutions and school education and has greatly influenced the training and instructional procedures.

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