Effectiveness of Constructivist Teaching Approach on Academic Achievement
Meta-Analysis

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Abstract

The purpose of the present research work was to conduct a meta-analytical study of the previously published research works related to the effectiveness of the constructivist teaching approach on the academic achievement of learners. For this work, keeping in mind the time series, the researcher selected 16 research papers to be published in the period from 2010 to the year 2021. The researcher(s) studied the effectiveness of the constructivist teaching approach on the academic achievement of the learners. After collecting quantitative data from selected research papers, they were converted into a standard scale, i.e., effect size, with the help of 'meta essential software'. After this, the average effect size was determined from these effect sizes. The average effect size of all studies yielded a value of 2.02 (very large effect size). Based on this, it can be concluded that there is a significant impact of the constructivist teaching approach on the academic achievement of the learners and the effect size is very large.

Introduction

Education is a social process that changes society, moving liabilities of instruction from guardians to educators and from family to school. Social orders change the viable utilisation of schooling in planning, creating, delivering, carrying out, and assessing educational programs. It helps to show the learning process in a study

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hall circumstance, increments both learning results also understudies' accomplishments, and lessens students' dropouts also, trouble, stress, nerves and disappointment (Chowdhury, 2016). So the present advancement of new showing methodologies is fundamental for all-around advancements of students. Crafted by Dewey, Montessori, Piaget, Brunner, and Vygotsky, among others; gives recorded points of reference to constructivist learning (Qarareh, 2016).

Constructivism addresses a change in outlook from instruction in light of behaviorism to constructivism. Behaviorist epistemology centers on insight, spaces of target, levels of information, and support. Formalisation of the idea of constructivism is, for the most part, credited to Jean Piaget, who explained components like that by which information is incorporated by the learners. He proposed that through the course of 'convenience' and 'absorption', people develop new information from their encounters (Khalid and Azeem, 2012).

Knowledge is not attained but constructed (von Glasersfeld, 1989). This statement came from a new challenge to the concept of traditional knowledge (Kim, 2005). In India, the National Curriculum Framework (NCF 2005) developed by the National Council of Educational Research and Training for school instruction has emphasised the constructivist approach to instructing and learning. The NCF 2005 suggests associating learning with real-life situations (Ranjan and Padmanabhan, 2018).

Constructivist teaching approach also has the main quality of activity and practicality (Kim, 2005). In this approach, both the student and the teacher create new knowledge collaboratively while being active. Constructivist teaching approaches make teaching effective and interesting, which increases the teacher's effectiveness and helps him achieve the learning objectives. At present, various innovative teaching methods are being used in education to enhance learning and enhance the quality of education. Constructivist teaching approaches and methods are based on heterogeneity rather than homogeneity in the classroom. Constructivist teaching approach is individual and specific to each learner and is tailored to the abilities, aptitudes, motivations and experiences of the learners. According to this diversity, curriculum adaptation strategies, such as reward-based learning, project method, multi-sensory approach, organising teaching-learning by providing work space as needed, working in groups, collaborative learning, learning by peer groups, team teaching, inter-scholastic grouping, multiple teaching should be done through age grouping, self-learning, various constructivist learning paradigms, etc. In constructivist teaching, an Individualised Education Programme is also developed based on the present level of performance of that concept in the classroom before

teaching any subject to the learners with specific needs. Thus, alternative and augmentative communication help learners who have articulation difficulties to communicate with or without external assistance (Science Pedagogy, 2018). Constructivist teaching methods are also related to new technology because, in these methods, the teacher uses new approaches and activities of technology during teaching-learning. Apart from this, constructivist teaching methods also use information and communication technology, its basic functional units like software packages, PPT, educational videos, and learning management resources (Innovative Teaching Methods, Training Module 2011-12).

Operational Definitions

Constructivist Teaching Approach

Constructivist teaching approach refers to the teaching approach in which the student is at the center of the teaching-learning process as opposed to the traditional method of teaching. In this process, the learner creates new and unique knowledge for himself as a result of the interaction of his previous knowledge and new situations. The teacher acts as a facilitator, creating a learning ecosystem in a constructivist teaching approach. In the present research work, the constructivist teaching approach refers to the different constructivist teaching methods/models included in the selected research papers.

Effectiveness

Effectiveness is the ability to produce the desired return or the ability to produce the desired output. Something is effective when it leads to an intended or expected result. In the present study, the meaning of effectiveness refers to the ability of the innovative teaching methods included in the selected research papers to produce desired results in the learners' academic achievement.

Academic Achievement

Academic achievement or academic performance is the degree to which a student, educator, or institution has achieved their short or long haul instructive objectives. In the present study, the meaning of academic achievement is refers to the marks obtained on the achievement test of students in the selected research papers.

Meta-Analysis

Refers to those statistical methods used for quantitative integration of the results obtained from quantitative research works (Gupta and Gupta, 2018). In the present research work, meta-analysis refers to the quantitative integration of the quantitative data obtained from selected research papers by converting them on a common scale (effect size).

Research Objective

The objective of the present research work was to conduct a meta-analytical study of the research work related to

the effectiveness of the constructivist teaching approach on the academic achievement of the learners. The quantitative analysis of research results is called meta-analysis (Gupta and Gupta, 2018).

Need and Importance of the Study

Meta-analysis is performed to evaluate the quality and quantity of the available evidence regarding an effect of treatment. Finding out whether an effect exists, figuring out whether it's positive or negative, and, ideally, getting a single, concise estimate of the effect are all goals. In the present research work, in the process of problem selection, various para-analytical research works done in the past were critically studied. In which it was seen that different researchers have done meta-analytical research works in different fields of knowledge and discipline. After studying the meta-analytical related research works done in the past, the researcher tried to know what is the combined effect of the experimental research works based on the constructivist approach in the time period from 2010 to 2021. Based on this rationale, the research work was completed by selecting this research problem by the researcher.

Method and Criteria for Selection of Previous Research Studies

Research studies from the period of 2010–2021 in the national and international areas on the effects of constructivist learning on the success rate were selected in this study. For this, both in Hindi and English, keywords such as 'constructivist learning', 'constructivist teaching-learning and academic achievement', 'constructivist teaching-learning environment', 'constructivist learning ecology', 'constructivism and academic achievement" were searched from different research journals and other research publication platforms such as www.ncert.ac.in, Research gate, Jstor, and Springer, etc., during this process, 93 related studies (according to the circumference of the researcher's knowledge) were found. Due to the lack of statistical measurements, 77 studies were not included in the present study. Only 16 research studies were included (all the research papers selected in this research work are shown in table number 2) in the present study on the basis of the following five major criteria—

1. Studies that used a constructivist approach and pre-test-post-test control procedures.
2. Studies that investigated the effect of a constructivist approach on learners' academic achievement.
3. Studies that reported sample size (N), mean (X), adjusted mean, standard deviation (SD) and t-value or F-value of experiment and control groups.
4. Studies conducted in national or international geographical areas.
5. Studies conducted between the years 2010–2021.
6. A very brief description of the selected research papers for the present research work is presented in Table 1.

Table 1
Very Brief Description of Selected Research Papers

S. No.	Journal Name	Volume	Issue	Year	Researcher(s)
1.	*Educational Research and Reviews*	5	7	2010	Oludipe Bimbola and Oludipe I. Daniel
2.	*International Journal of Humanities and Social Science*	2	5	2012	Abida Khalid and Muhammad Azeem
3.	*Global Journal of Environmental Science and Technology*	1	2	2014	Peter Ogbu Agogo and David AondofaNaakaa
4.	*International Journal of Research in Social Science and Humanities*	5	1	2015	Pranab Barman and Dibyendu Bhattacharyaa
5.	*IOSR Journal of Humanities and Social Science*	21	2	2016	Sushanta Roy Chowdhury
6.	*International Education Studies*	9	7	2016	Ahmed O. Qarareh
7.	*Paripex-Indian Journal of Research*	5	3	2016	Uzma Siddiqui
8.	*Journal of Education and Practice*	8	13	2017	Laxmi Pandey and Devendra Ameta
9.	*Journal of Education, Society and Behavioural Science*	24	3	2018	N. B. Naade, J. I. Alamina and P. C. Okwelle
10.	*Educational Quest: An International Journal of Education and Applied Social Science*	9	3	2018	Shashi Ranjan and Jubilee Padmanabhan
11.	*International Journal of Culture Research*	10	4	2018	Vanita Anand and Vipasha Rana
12.	*International Journal of Scientific and Research Publications*	9	6	2019	Julius Drambi Lakama
13.	*International Journal of Education, Modern Management, Applied Science and Social Science*	2	1	2020	Sheena Thomas
14.	*Pakistan Social Science Review*	4	3	2020	Ghazala Noureen, Tahseen Arshad and Muqadas Bashir
15.	*Bhartiya Adhunik Shiksha*	40	3	2020	Ranjay Kumar Patel and Shireesh Pal Singh
16.	*Review of International Geographical Education*	11	10	2021	Suhad Abdul Ameer Abbood

Data Collection

In the context of the present study, for reviewing the related literature, the researcher has studied the various research works done from 2010–2021 related to the constructivist teaching-learning process (according to the circumference of the researcher's knowledge) by purposive selection. These research papers were selected from different research journals and other research publication platforms such as Research Gate, Jstor, and Springer, etc. In the present study, the researcher collected quantitative data from all the selected 16 research papers. The details of quantitative data are presented in Table 2.

Table 2

Details of Quantitative Data of Selected Research Papers

S. No.	Researcher(s)	Group	N	Mean/ Adjusted Mean	Standard Deviation	t/F
1.	Oludipe and Oludipe	Experimental	60	31.90	2.40	40.52
		Control	60	15.18	2.11	
2.	Khalid and Azeem	Experimental	31	522.22	32.06	5.63
		Control	32	441.18	63.42	
3.	Agogo and Naakaa	Experimental	80	2.827	0.569	0.12
		Control	67	2.842	0.566	
4.	Barman and Bhattacharyaa	Experimental	25	45.63	5.23	7.53
		Control	25	34.78	4.97	
5.	Chowdhury	Experimental	30	59.50	5.12	5.87
		Control	30	51.50	5.42	
6.	Qarareh	Experimental	68	25.79	3.00	4.38
		Control	68	23.06	4.17	
7.	Siddiqui	Experimental	30	18.59	0.27	30.57
		Control	30	16.44	0.27	
8.	Pandey and Ameta	Experimental	40	42.50	5.60	3.20
		Control	40	31.50	3.50	
9.	Naade, Alamina and Okwelle	Experimental	28	68.93	13.42	3.923
		Control	30	57.00	9.52	
10.	Ranjan and Padmanabhan	Experimental	35	18.05	2.94	5.90
		Control	35	12.68	4.62	
11.	Anand and Rana	Experimental	31	39.74	2.7	14.96
		Control	31	28.70	3.4	
12.	Lakama	Experimental	33	13.82	2.11	6.31
		Control	25	9.92	2.59	

13.	Thomas	Experimental	97	45.73	7.01	7.26
		Control	92	35.48	11.89	
14.	Noureen, Tahseen and ashir	Experimental	30	17.63	2.49	6.01
		Control	30	13.10	3.28	
15.	Patel and Singh	Experimental	43	26.47	-	=56.704
		Control	42	21.49	-	
16.	Abbood	Experimental	30	35.28	6.34	3.84
		Control	29	29.04	6.12	

The above table presents the quantitative data collected from the content analysis of selected 16 research papers. In content analysis, sample size, mean or adjusted mean, standard deviation, t-value, or F-value have been taken while collecting maximum data from selected research papers.

Data Analysis and Interpretation

The quantitative data collected in the present research study was meta-analysed. Meta-analysis aims to do statistical integration of the results obtained from the same type of studies. In the meta-analysis, the average effect size is obtained by converting the numerical results from different studies into a common scale, i.e., effect size (Gupta and Gupta, 2018). In the present research study, 'meta essentials software' was used to perform the meta-analysis of the collected quantitative data. The software is available free of cost on the website of the Erasmus Research Institute of Management (ERIM), University of Rotterdam, Netherlands. The central feature of this software is that it converts the effect size and then into the average effect size with the help of minimal quantitative data obtained from various studies.

The results of quantitative data analysed with the help of 'meta essentials software' are presented in Table 3.

Table 3

Study-wise Individual Effect Size and Average Effect Size

S. No.	Researcher(s)	Effect Size	Comment
1.	Oludipe and Oludipe (2010)	7.35	Very Large Effect Size
2.	Khalid and Azeem (2012)	1.40	Very Large Effect Size
3.	Agogo and Naakaa (2014)	0.02	Ignored
4.	Barman and Bhattacharyaa (2015)	2.10	Very Large Effect Size
5.	Chowdhury (2016)	1.50	Very Large Effect Size
6.	Qarareh (2016)	0.75	Moderate

7.	Siddiqui (2016)	7.79	Very Large Effect Size
8.	Pandey and Ameta (2017)	0.71	Moderate
9.	Naade, Alamina and Okwelle (2018)	1.02	Large Effect Size
10.	Ranjan and Padmanabhan (2018)	1.39	Very Large Effect Size
11.	Anand and Rana (2018)	3.75	Very Large Effect Size
12.	Lakama (2019)	1.65	Very Large Effect Size
13.	Thomas (2020)	1.05	Large Effect Size
14.	Noureen, Arshad and Bashir (2020)	1.53	Very Large Effect Size
15.	Patel and Singh (2020)	1.62	Very Large Effect Size
16.	Abbood (2021)	0.99	Large Effect Size
Average Effect Size		**2.02**	**Very Large Effect Size**

From the observation of the above Table 3, it is clear that, except for the study of Agogo and Naakaa (2014), all other studies show moderate to substantial effect sizes (Cohen, 1988). The last row of the table shows the average effect size of all studies with a value of 2.02. The value shown in the guide table for effect size propounded by Cohen is greater than 1.2 (Cohen, 1988). That is, there is considerable effect size. As a result, it can be said that the constructivist teaching approaches have a considerable effect size on the academic achievement of the learners.

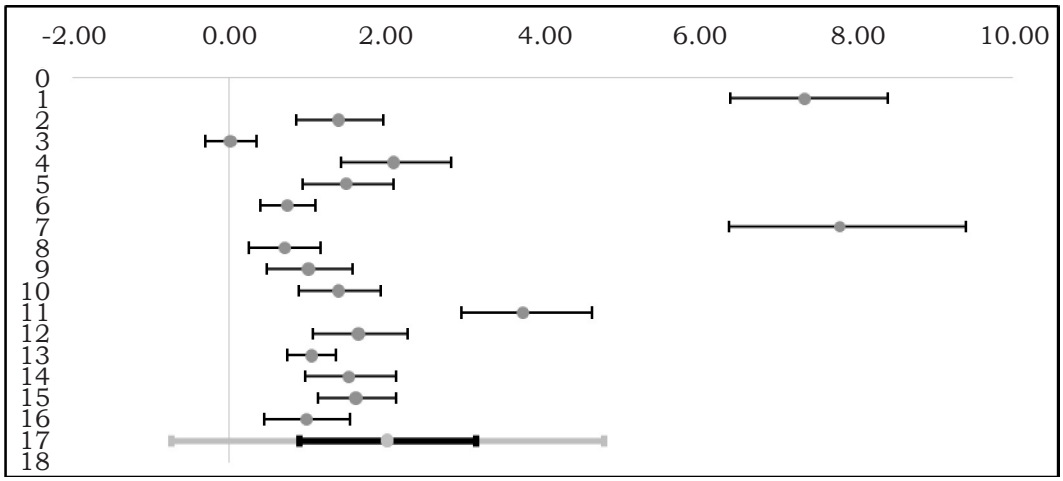
Observing the forest plot of the effect size, it is clear that the x-axis at the top of the plot is the scale of the effect size marked. The midpoint of each row except the bottom row (row number 17) of the forest plot represents the effect size of an individual study with a 95 per cent confidence interval. The bottom row (or 'summary row') of the forest plot represents the result of the meta-analysis. This meta-analytical result of meta-essentials (line 17 in graph 1) consists of two intervals, both around the same bullet. This bullet represents the *weighted average effect*, to which we will refer as the 'combined' effect size. The smaller, black interval is a *confidence interval*. The larger, green interval is the *prediction interval*. The value of 2.02 is also called the combined effect size or the weighted average effect size.

Table 4

Z and Significance Values

Z-value	**3.83**
One-tailed p-value	0.000
Two-tailed p-value	0.000

It is clear from the observation of Table 4 that the average effect size has a z-value of 3.83 with a two-tailed significance value of 0.000, respectively, at the 0.05 significance level. Therefore, this value is less than 0.05 and is significant at the



Graph 1: Forest plot of the effect size

0.05 level of significance. In this perspective, the null hypothesis that the constructivist teaching approach does not significantly affect the learners' academic achievement can be rejected. As a result, it can be said that there is a significant effect of the constructivist teaching approach on the academic achievement of the learners.

Research Conclusion and Discussion

The purpose of the present research work was to conduct a meta-analytical study of the research work related to the effectiveness of the constructivist teaching approach on the academic achievement of the learners. After the analysis of quantitative data collected in the study, it was found in the form of research finding that the constructivist teaching approach has a significant and very large effect on the academic achievement of the students. The result of this research is also correlated with the research works of Semerci and Batdi (2015); Anil and Batdi (2015); Ayaz and Şekerci (2015); Balta, Arslan, and Duru (2015); Balta and Sarac (2016); Mayasari, Handhika, Huriawati, Sasono, Kurniadi, Purwandari and Yusro (2018); and Arik and Yilmaz (2020). These researchers also found in their respective meta-analytical research studies that there is a positive and significant effect of constructivist and learner-centered teaching methods and approaches on the academic achievement of different levels of students and the effect size of these teaching methods and approaches is also large. The main reason for the magnitude of the present research can also be the systematic and effective presentations of the selected subject matter for teaching by the constructivist teaching approach, the age, interest,

aptitude, ability, and individual differences of the learners in the selection of the subject matter. Care is taken, and each learner is given opportunities and sufficient freedom to learn at their own pace. Because constructivist teaching-learning theory also believes that children should be provided with such a learning situation where they can get enough opportunities to construct knowledge keeping in mind their age, interest, aptitude, ability, and individual differences and freedom to learn (Science Pedagogy, 2018).

Children are active by nature, and while learning through constructivist methods, the child uses more of his senses in the learning process while remaining active, which makes learning easy, and engaging (Jha, 2009). One reason for the research presented from this perspective is that there may also be active participation of children.

In addition, the epistemology of constructivist teaching methods, making the learning ecology of the classroom learner-centered, considers the role of the student as the principal and the role of the teacher as the facilitator, and the learning ecology in which the learner is in the dominant role, of course, he learns effectively there. This may also be a major reason for the presented research results.

Educational Implications

The educational implications of this research work can be as follows:

For Policy Makers

This study indicates (study shows very high effect size, i.e., increase academic achievement) that students increase their academic achievement by acquiring knowledge based on interest, self-acceptance, competence, and individual differences in the learning environment created with the help of constructivist teaching methods in their classroom. (Jha, 2009). Therefore, in the light of these results, this study will provide a basis for the development of the curriculum of the subjects and the makers of educational policies, which will help them to develop the curriculum based on constructivist and constructivist teaching-learning principles while developing the curriculum of various subjects. With the help of this, the students' academic achievement can be increased.

For Teachers

The result of the present study will provide the basis for teachers to choose constructivist teaching methods in place of traditional teaching methods (teacher–centered teaching methods like lecture method) for teaching work. The nature of the subject matter is different for different subjects. For which the teacher chooses different teaching methods/models for teaching (which based on principles of learner centered education like 5E constructivist model, 7E constructivist model, 9E constructivist model, ICON model, VIOCES model, metacognitive

learning cycle model, constructivist learning design model, motivational model for constructivist-informed teaching, RIE model, etc.)

It is clear from the results of the present research work that constructivist teaching methods increase the academic achievement of the students, so based on this, the teacher can make a meaningful increase in the achievement of the students by choosing constructivist teaching methods and teaching paradigms for the teaching of their subject.

In the Selection of Appropriate Methods for Assessing the Learning of Students

At present, constructivist assessment methods are being used in place of traditional methods to check the learning progress of students. These assessment methods help the teacher to assess the learning progress of the students as well as assess their own learning. So that teachers can make necessary changes in the teaching-learning process of their classroom (Gangwar and Singh, 2020). The National Policy on Education, 2020 suggests that teachers should use student-centered and constructivist assessment methods such as rubrics, portfolios, projects, and group activities to assess the knowledge of students as well as the process of knowledge formation. The present research will acquaint teachers with constructivist teaching methods that enhance academic achievement. Accordingly, the teacher can check the learning progress of the students by incorporating appropriate constructivist assessment methods like concept-related activities, portfolios, and rubrics, etc., along with the teaching-learning process for formative assessment of various subjects of the students of the class. (Mohapatra, Mahapatra and Parida, 2019).

For Book Authors

This study indicates that constructivist teaching methods have a significant impact on students' academic achievement and the size of this effect is very large. In this context, this research work will also provide the basis for book writers of different subjects to organise and present the subject matter included in their book in interesting, student-centered, systematic, and simple words, as a result, it becomes easier for the students to learn new concepts, and their academic achievement can be increased.

For Other Researchers

The research process and result of this research work will also be helpful for those researchers who are interested in meta-analytical research work and want to do this type of research work.

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