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Exploring Science Teachers' Perceptions Regarding the Constructivist Approach

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ABSTRACT

A constructivist approach shifts the focus from traditional teacher-led instruction to a more collaborative, engaging environment where students take responsibility for their learning. This approach fosters active participation, deeper understanding, personalized learning experiences, and prepares students with the skills needed for real-world challenges. In a constructivist teaching, the teacher's perceptions towards teaching should support individual learning, provide constructive feedback, create an inclusive environment, and encourage collaboration among students. Based on this concept, the study aims to explore the levels of perceptions, as well as the influence of gender, types of schools, and their interaction on the perceptions of secondary school science teachers regarding the constructivist approach. In this research, the "perceptions of teachers towards constructivist approach" scale was administered to collect the data on a sample of 130 government and private secondary school science teachers of District Aligarh of U.P. The Scale was constructed and standardized by the researchers. The reliability of the scale was 0.901. The obtained data were analyzed using statistical tests, 2×2 Factorial Design ANOVA, and percentages. The finding revealed that, compared to their male counterparts, female science teachers showed very good perceptions of the constructivist approach. On the contrary, compared to their counterparts in government schools, science teachers of private schools possessed better perceptions of the constructivist approach. This study also shows that perceptions of science teachers are significantly influenced by both gender and school type, but the interactions between gender and types of schools do not significantly impact perceptions of science teachers regarding the constructivist approach.

Keywords: Constructivist approach, Constructivist teaching, Perceptions, Science education, Science teacher, and Secondary school

The quality of education is an important factor in determining the progress of a nation, and a key component of the overall educational process is the teaching-learning approach. A strong teaching strategy allows the development of human potential, considers the variety of needs of the students, and strengthens the learning environment. The demands placed on classrooms in the twenty-first century diverge from those in the twentieth. These days, we need to realize that teachers should have the knowledge, skills, and innovative approaches to shape a student's occupational, moral, and social development. It is a widely held belief that scientific advancement and a community with a knowledge of science are necessary for a nation to survive peacefully in the twenty-first century. Furthermore, the National Education Commission (1964–1966) and the newly established NEP–2020 have also emphasized science education. The dominance of science and technology is unquestionably one of the most important factors in promoting socioeconomic development and democratic citizenship in a society. Stressing the value of science education

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in this setting is crucial for addressing teenage students' demands using the most effective teaching approach. A paradigm change from the traditional to a new approach, such as the constructivist approach, is required to ensure the science education goal. Student-centered teaching approaches play a vital role not only in the foundation of students' careers and overall development but also give creative direction for the well-being of the nation.

Constructivist Approach

The "constructivist approach stance maintains that learning is a process of constructing meaning; it is how people make sense of their experience" (Caffarella and Merriam, 1999). This perspective holds that individuals create new knowledge by drawing on what they already know, and interactions with the environment are an important aspect of this process. Since constructivism recognizes and appreciates the learner's perspective, the student readjusts and reevaluates their knowledge and understanding rather than labeling it as "right" or "wrong." Piaget (1977) stated that learning happens actively, through the construction of meaning, rather than passively. As per his claim, a state of disequilibrium or imbalance arises when a student experiences an event or circumstance that challenges their cognitive abilities. To achieve equilibrium, students must modify their thought processes by making connections between new information and what they already know. We can therefore refer to it as a constructivist learning approach. The central idea of constructivism comes from (Lev Vygotsky's, 1934) theories regarding the mind, language, and society's role in regulating them. Vygotsky's anti-realist thought suggests that society and culture operate as a mediating force and that learning is influenced by others' actions. Constructivism values the child's progressive internalization of social and external behaviors, such as communicating with more mature and capable persons.

John Dewey (1859–1952) believed that learning is based on action, knowledge of the outside world, and concepts can only emerge when students are forced to reflect on experiences that are significant and relevant to their daily lives. According to Dewey's research, the process of solving practical problems in the human mind involves testing competing hypotheses. These problem-solving exercises occur in a cooperative environment, like a classroom, where students work together to manipulate materials and produce concrete outcomes. In the constructivist approach, peer interaction is called socio-cognitive conflict and is essential to learning for solving problems (Light and Littleton, 1999). For this reason, peer interaction has received more attention and is emphasized by the constructivist approach.

Teachers' role in constructivist classrooms

Teachers in a constructivist classroom provide opportunities for students to challenge their own and others' preconceptions. As a result, a constructivist teacher creates situations that question standard concepts and assumptions. Teachers and peers facilitate and contribute to learning through the use of constructivist principles, including scaffolding, mentoring, learning communities, collaborative learning, and cognitive training (Rogoff and Brown, 1998). Constructivist teachers adjust their perspectives on knowledge and their way of thinking to truly enhance learning. According to Giroux (1986), teachers are regularly instructed to apply multiple models of teaching and evaluation, but they are not taught to question the assumptions that underpin these models. He recommends that teachers be more than technologists, but transformative thinkers who engage in critical discussion with their students.

Review of literature

Various studies have identified the effectiveness of the constructivist approach, such as (Tekos, 2009), (Dhindsa, 2010), (Brooks & John, 2010), (Gharibi & Aydisheh, 2015), (Yaduvanshi, 2015), (Harkness, 2016), and (Maheshwari, 2017). So many studies are related to the perceptions of teachers regarding the constructivist approach, as Koh Ling (2014) explored that teachers' perceptions of content, pedagogical, and technological knowledge showed the strongest positive relationship with constructivist-oriented pedagogical content knowledge. Melesse & Jirata (2015) also found that respondents had low constructivist teaching approach practices, but they perceived the constructivist teaching approach. Guha & Paul (2014) revealed that although teachers may be theoretically competent in constructivism, they

have not yet taken a strong position (by developing a high attitude) for implementing the constructivist vision into practice in actual classroom settings. In this regard, Vermette (2001) suggested that teachers should improve their understanding of this approach and be better prepared to design lessons. Kasapoglu (2010) revealed that implementing constructivist teaching and learning activities significantly and substantially correlated with teachers' perceptions of the curriculum change. Taskin-Can (2013) main findings showed that pre-service science teachers generally retain teacher-centered beliefs. The outcomes of all the studies came to nearly similar conclusions, revealing that respondents' constructivist teaching approach practices were low, but they had perceptions of the constructivist approach. These findings lead us to the conclusion that conventional teacher-centered education has continued under the guise of a constructivist approach.

Rationale of the study

In the present scenario, all the teachers are trying to change the pattern of teaching because the students' participation is the least in the existing teaching-learning system. Now, education is moving from the traditional approach to a child-centred approach, and teachers are trying to incorporate more innovative approaches. In this regard, the constructivist approach is one of the most effective approaches to attaining the desired learning outcomes. This approach mainly focuses on the process, which means that how to learn is more important than what is to be learned. So, to implement this approach in science classrooms, the teachers are a very important component of the teaching-learning process. Unfortunately, on the ground level in our country, secondary school teachers have very little understanding of the philosophy of constructivism. To implement the constructivist approach in the classroom, teachers must have a deep understanding and a very good perception of this approach. That's why this descriptive study was conducted to explore the ground reality of perceptions of secondary school science teachers regarding the constructivist approach. This study will also benefit the teacher educators and administrators in improving the implementation of the constructivist approach.

Objectives of the study

- The following objectives were framed for the present study:
- To study the Perceptions of secondary school science teachers regarding the constructivist approach.
- To explore the influence of Types of schools, Gender, and their interaction on the Perceptions of science teachers regarding the constructivist approach.

Hypotheses of the study

A series of null hypotheses were formulated for empirical verification as follows:

- There is no significant Influence of Gender on the Perceptions of science teachers regarding the constructivist approach.
- There is no significant Influence of Types of schools on the Perceptions of science teachers regarding the constructivist approach.
- There is no significant Influence of interaction between Types of schools and Gender on the Perceptions of science teachers regarding the constructivist approach.

Methodology

The current study employed the descriptive survey method. In this study, the dependent (or criterion) variable was science teachers' perceptions, while the independent (or predictive) variables were gender and types of schools.

Sample and Sampling technique

For the current study, a simple random sampling technique was used to collect the data from 130 secondary school science teachers. There were 70 male teachers and 60 female teachers from both government and private schools of Aligarh city, Uttar Pradesh.

Tool used in the study

For this study, one self-constructed scale, i.e., "Perceptions of teachers towards constructivist approach," was used to collect the data. Cronbach's alpha was estimated to determine the reliability of the scale, and it was found to be 0.901.

Data collection and scoring

To collect the data, all the participants were contacted personally and asked questions regarding the constructivist approach namely "Understanding of the concept", "related to Attitude", "Implementation strategy", "Use of ICT and other resources", "School environment", "Role of facilitators and learners," having 46 items in total through a questionnaire. After collecting data from all the respondents, scoring was done. As the responses were obtained on a five-point rating scale as 'Strongly agree', 'Agree', 'Undecided', 'Disagree', and 'Strongly Disagree' categories, all the responses were tabulated in the form of frequency under five categories.

Statistical techniques

For the data analysis, the researchers used descriptive statistics such as mean and Percentage. For inferential analysis, researchers used parametric statistics such as a 2×2 Factorial Design ANOVA.

ANALYSIS AND INTERPRETATION

Objective: 1

To study the Perceptions of secondary school science teachers regarding the constructivist approach.

To achieve this objective, percentages of levels of perceptions under five categories, as 'Very good', 'Good', 'Moderate', 'Poor', and 'Very poor', were calculated and tabulated in the table 1.

Table 1 shows the levels of Perceptions regarding the constructivist approach for the total sample (130) of science teachers. It can be seen from Table 1, only 5.38% of the science teachers were found to have "very good" perceptions, 21.54% of the science teachers possess "good" perceptions, 40.77% of the science teachers have "moderate" perceptions, 17.69% of the science teachers having "poor" perceptions and 14.61% of the science teachers having "very poor" perceptions. The picture is further clear from the visual representation of the levels of perception for the total sample of science teachers as shown in Fig. 1:

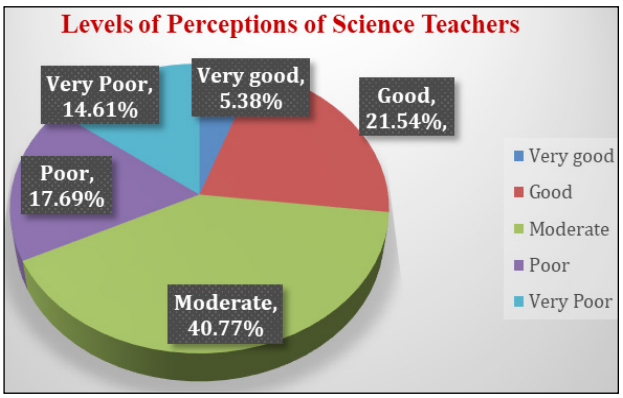

Fig. 1: Pie chart showing the levels of Perceptions of the total sample of secondary school science teachers regarding the constructivist approach

Interpretation based on Gender

Table 1 shows the levels of perception regarding the constructivist approach for the male sample (70) and female sample (60) of science teachers. It can be seen from Table 1 that 5.71% of the male and 15% of the female science teachers have very good perceptions. On the same line, 12.86% of the

Table 1: Perceptions of Science Teachers regarding the Constructivist Approach

Sl. No.	Groups	Number	Very Good (204 and above)	Good (183-203)	Moderate (162-182)	Poor (141-161)	Very Poor (140 and below)
1	Total Sample	**130**	5.38% (N=7)	21.54% (N=28)	40.77% (N=53)	17.69% (N=23)	14.61% (N=19)
2	Male Sample	**70**	5.71% (N=4)	12.86% (N=9)	47.14% (N=33)	25.71% (N=18)	8.58% (N=6)
3	Female Sample	**60**	15% (N=9)	28.33% (N=17)	41.66% (N=25)	10% (N=6)	5% (N=3)
4	Government School Sample	**55**	7.27% (N=4)	23.64% (N=13)	41.82% (N=23)	20% (N=11)	7.27% (N=4)
5	Private School Sample	**75**	13.33% (N=10)	30.67% (N=23)	38.67% (N=29)	12% (N=9)	5.33% (N=4)

male while 28.33% of the female science teachers have good perceptions. On the other hand, 47.14% of male and 41.66% of female science teachers have moderate perceptions. Furthermore, 25.71% of the male and 10% of the female science teachers have poor perceptions. On the same line, 8.58% of male and 5% of female science teachers have very poor perceptions. The picture is further clear from the graphical representation of the levels of perception of male and female science teachers regarding the constructivist approach, as shown in Fig. 2.

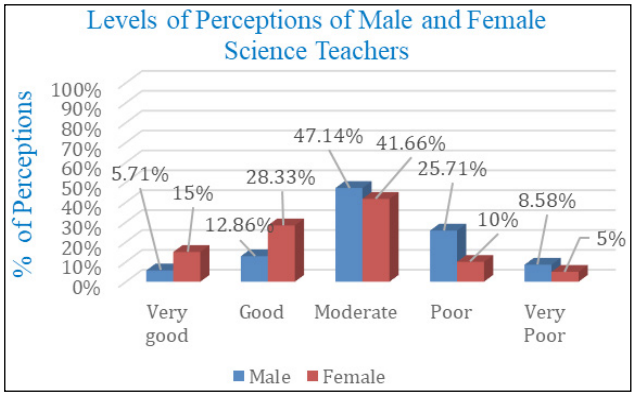

Fig. 2: Levels of Perception of Male and Female secondary school science teachers regarding the constructivist approach

Interpretation based on Types of schools

Table 1 shows the levels of Perception regarding the constructivist approach for the government school sample (55) and private school sample (75) of science teachers. It can be seen from Table 1 that 7.27% of the government and 13.33% of the private school science teachers have very good perceptions. On the same line, 23.64% of the government and 30.67% of the private school science teachers have good perceptions. On the other hand, 41.82% of government and 38.67% of private school science teachers have moderate levels of perceptions. Furthermore, 20% of government and 12% of private school science teachers have poor perceptions. On the same line, 7.27% of government and 5.33% of private school science teachers have very poor perceptions. The picture is further clear from the graphical representation of the levels of perception of government and private secondary school science teachers regarding the constructivist approach, as shown in Fig. 3.

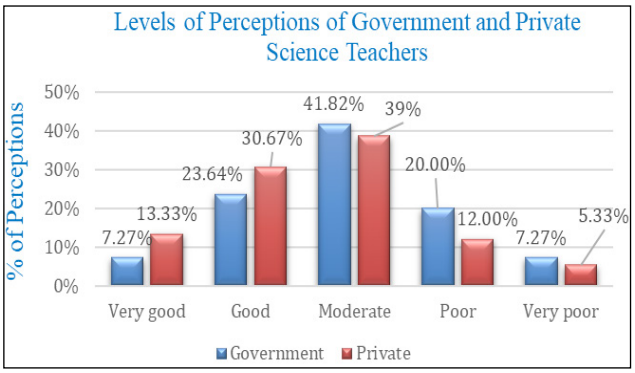

Fig. 3: Levels of Perception of Government and Private secondary school science teachers regarding the constructivist approach

Objective: 2

To explore the Influence of Types of schools, Gender, and their interaction on Perceptions of science teachers regarding the constructivist approach.

The aim was to explore the Influence of types of schools, gender, and their interaction on the Perceptions of science teachers. Private and Government were the two categories of types of school, while male and female were the two groups of gender taken in the study. Thus, by using a parametric test, 2×2 Factorial Design ANOVA, the data were analysed, and the findings are shown in Table 2.

Table 2: Summary of 2×2 Factorial Design ANOVA of Perceptions of Science Teachers

Source of variance	Mean		df	SS	MSS	F-value	p-value
Gender (A)	Male	161.40	1	8904.35	8904.34	112.84	0.00*
	Female	178.44					
Types of school (B)	Government	155.93	1	23994.34	23994.34	304.06	0.00*
	Private	183.90					
Interaction (A×B)	126		1	282.24	282.24	3.58	0.061
Error	130		9943.11	78.91			
Total			3728193.00				

**Significant at .01 level (p-value<.01).*

Influence of Gender on Perceptions of Science Teachers

Table 2 shows that the Gender of science teachers has an F-value of 112.84, which is found significant at the 0.01 level of significance with *df* = 1/126. It reveals that gender variation influences the perceptions of science teachers. As a result, the null hypothesis that Gender has no significant influence on the Perceptions of secondary school science teachers regarding the constructivist approach is rejected. Furthermore, female science teachers have a mean score of perceptions is 178.44, which is significantly greater than their male counterparts, science teachers, who have a mean perception value of 161.40. Hence, it can be concluded that in comparison to male science teachers, female science teachers have considerably better perceptions of the constructivist approach.

Influence of Types of schools on Perceptions of science teachers

The F-value for Types of schools is 304.06, which is significant at the 0.01 level of significance with *df* = 1/126 (vide Table 2). It suggests that types of school variation make a difference in the perceptions of science teachers. As a result, the null hypothesis stating that the Types of schools have no significant influence on the perceptions of secondary school science teachers is rejected. In addition, the value of the mean for perceptions of Private school science teachers is 183.90, which is much higher than that of Government school science teachers, whose mean value of perceptions is 155.93. Consequently, it may be concluded that science teachers of private schools have better perceptions of the constructivist approach than science teachers of government schools.

Influence of Interaction between Gender and Types of Schools on Perceptions

From Table 2, the interaction between Gender and Types of schools has an F-value is 3.58, which is not significant at the 0.05 level of significance with *df* = 1/126. Thus, the data shows no significant difference between the mean value of perceptions of male and female science teachers belonging to the government and private schools. Thus, the null hypothesis framed that the interaction between gender and school type has no significant influence on the perceptions of science teachers is not rejected. It may, therefore, be said that secondary-level male and female science teachers teaching in Government and Private schools were found to have the same extent of perceptions of the constructivist approach. The picture is further illustrated by the trend of the interaction between types of school and gender on science teachers' perceptions, as shown in Fig. 4.

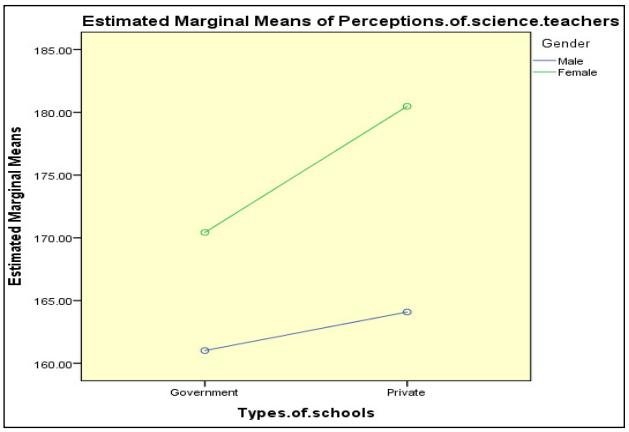

Fig. 4: The trend of influence of interaction between Gender and Types of school on Perceptions of science teachers

RESULTS AND DISCUSSION

The first finding pertains to the primary objective of the study, a very small proportion of secondary school science teachers have very good perceptions of the constructivist approach. This finding draws support from the results of Acat *et al.* (2010) that even after the workshop on creating constructivist learning environments, school teachers and students were still struggling to understand the constructivist approach. Taskin-Can (2013) found that pre-service science teachers keep holding on to teacher-oriented education, which has been consistently implemented under the label of constructivism. Similarly, Melesse & Jirata (2015) found that although teachers are aware of the constructivist teaching approach, they hardly ever put it into practice. Kiew & Sihes (2010) found that while the majority of student-teachers of chemistry have an adequate knowledge of the constructivist approach, very few of them use it in their classroom teaching. The findings of the research are consistent with Yang *et al.*'s (2008) findings, which showed that teachers are reluctant to use the constructivist approach in the classroom since it contradicts their epistemological beliefs. However, research with contradictory results was also found by Kinay & Han (2017) that prospective

teachers had adopted more constructivist beliefs than traditional beliefs.

The second finding, which relates to the second objective of the study, shows that gender has a significant main effect on perceptions of secondary school science teachers. More specifically, it was discovered that as compared to their male science teachers, female science teachers showed far better perceptions of the constructivist approach. The results of Wandaphisha (2016), Shahida & Jamal (2021), and Gecit (2016) add support to this finding that female teachers have a much more positive attitude towards the constructivist approach than male teachers. Additionally, Lyngdoh & Sungoh (2017) also revealed significant gender differences in attitudes regarding the constructivist approach. On the other hand, Sthapak & Singh (2017) and Jain & Mir (2016) found contradictory results showing no significant influence of gender on attitude towards constructivist teaching among pre-service teachers and secondary school teachers. Similarly, Guha & Paul (2014) found no significant differences in attitudes regarding the constructivist approach based on the school location and gender.

The third finding of the present study is also connected to the second objective, that perceptions of secondary school science teachers have significant differences based on the types of schools. Compared to science teachers of government schools, the constructivist approach was shown to be significantly better perceived by those of private schools. The result draws support from the results of Khan et al. (2016), which reveal that private school teachers perform significantly better than those in government schools. Based on the types of institutions, Similar findings have been reported by Kishan (2021) and Ali (2020), who concluded that private schools prioritize high-quality education and perform better than government-run schools.

Educational Implications

Though the study was conducted on a small sample, even then, the researchers very humbly submitted the following educational implications:

- This study found that a very small proportion of science teachers have very good perceptions of the constructivist approach, so the government needs to make sure that teachers have plenty of opportunities to gain an understanding of the new approaches, like the constructivist approach. To meet the need, experienced speakers in various training programs should be invited regularly.
- This empirical study found that, as compared to their male science teachers, female science teachers showed better perceptions of the constructivist approach. Thus, to improve the new approach to teaching effectively in the classrooms, teachers must help their colleagues and try to implement the new approaches with their fellow staff.
- This research reflects that private school science teachers have better perceptions of the constructivist approach than government school science teachers. In this context, government school principals should try to provide all the necessary opportunities and resources, like ICT, lab equipment, arrangement of field trips, internet, and other open educational resources (OERs) to perceive and implement the constructivist approach.
- Study suggests that to promote constructivist teaching in science classrooms, the administration should take all the necessary actions so that school teachers feel like independent facilitators in such an open and flexible environment and are motivated to implement the constructivist approach.

CONCLUSION

Finally, it may be concluded that this study aimed to explore secondary school science teachers' perceptions of the constructivist approach, focusing on the levels of perceptions and examining the influence of gender, type of school, and their interaction. From the findings of the study, we can conclude that for the total sample, most of the secondary school science teachers have moderate levels of perceptions, and a very low percentage of them were found to have very positive perceptions of the constructivist approach. Based on the above findings, gender and types of schools significantly affect the perception of science teachers regarding the constructivist approach. The lack of time to cover the syllabus, as well as teachers' lack of knowledge and skills, large class sizes, and lack of instructional material, were the key problems affecting the effective adoption of the constructivist

approach. Hence, the government and policymakers should provide the required training to the teachers to become better than they are. Teachers should have very good perceptions and the required skills to implement the constructivist approach. Science teachers should have an understanding of various teaching methods that reflect this approach. Constructivist teaching relies on several active teaching methods such as inquiry-based learning, collaborative learning, and project-based activities. Hence, we can say that it is the ideal approach for imparting science education.

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